RAILROAD GAZETTE

FRIDAY, JULY 26, 1901.

CONTENTS

Contributions

Mechanical Stoking.

TO THE EDITOR OF THE RAILROAD GAZETTE.

The man who is able to prove the advantages of his one-shovel system of firing, on the small engines built a decade ago, finds his argument unavailing when he approaches the fireman of one of the modern monsters, with wide and long fire-box. To the latter it seems like trying to moisten the bottom of a large tub with a single drop of water.

The large engine has come to stay, for commerce has made it necessary. Its imperfections must be allowed for, and remedied one by one. The firing of all engines by the sprinkling process is conceded to be the only correct way in which to effect economy in fuel and abate the smoke nuisance. This the fireman was able to do fairly well on the small engines by the one-shovel system, but the larger ones have made necessary the employment of mechanical means. In using the practicable stoker, no matter how large the engine, it will sprinkle the coal more evenly and thinly than is possible by hand, and exceeds the system of one-shovel firing as in practice on small engines, and there is no smothering of the fire, as nearly all of the finer coal is ignited before reaching the bed of coals, and for this reason slack can be successfully used in the stoker, while in hand-firing a considerable amount of it would fall unconsumed through the grates. This machine was illustrated and fully described in your issue of May 24. While this machine is intended for use on all sizes of locomotives its greatest field of usefulness is in firing the large engines, such as cannot be successfully fired by hand.

FIREMAN.

On Some of the Defects in Track Surface.

Elkins, W. Va., June 14.

TO THE EDITOR OF THE RAILROAD GAZETTE.

It has been long ago pointed out that the question of smooth riding may not be merely one of stiffness or rigidity of rail joints. It is on this line mainly that I wish to offer a suggestion or two and to ask you and others to observe and think.

Assuming that the perfect joint is made and in use might not trouble still arise from the effect of a wave-like motion in the rail under the great loads of modern traffic which would tend gradually to produce low places at some points, leaving longer and longer spaces of the rail unsupported and high places at others, increasing and extending the evil? This it seems to me would be the case particularly with certain kinds of ballast as fine gravel or sand and more or less with other kinds. Besides the depressions there are elevations caused by the sifting in of material into the old tie bed. I know that many old trackmen scout the idea of any such thing occurring in practice to an appreciable extent, or of remedying it, if it does occur, by any other means than that of the use of better ballast properly applied; but I still submit the idea for your consideration as well as a suggestion or two in the way of a possible remedy.

I suggest the expediency in certain cases of using rail supports of such form and dimensions as would tend to form and maintain an anchorage of the rail and track superstructure generally into the underlying material of the roadbed. The additional cost of this might be met by the use, in part, of a heavier rail, deeper in the web and stiffer, with the supports farther apart.

These ideas are, of course, only applicable to certain conditions of roadbed and ballast, where the underlying material is of a soft and yielding nature and the ballast fine and likely to run.

It has seemed to me not unlikely indeed that even in rock ballast of certain kinds the results of shock and abrasion might gradually produce a fine material likely to act to some extent just like sand or fine gravel.

I was much interested in the articles by Mr. Lindenthal on track superstructure, published some time ago, and from the shape and arrangement given the parts of his proposed designs for track as well as his remarks in connection therewith think that he had the same ideas as to defects of track that are given above.

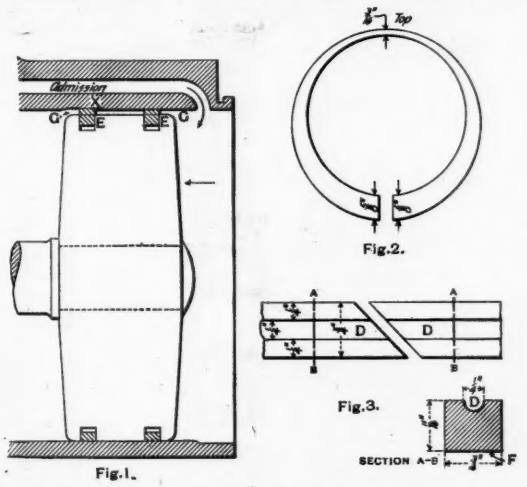
C. H. S.

Wear of Locomotive Cylinders and Packing Rings.

TO THE EDITOR OF THE RAILROAD GAZETTE.

The wear of locomotive cylinders has been pretty thoroughly discussed in the various mechanical papers, and considerable thought has been given to the design of a packing ring of sufficient width to obtain an efficient wearing area, and at the same time avoid excessive friction. The wear of locomotive cylinders is greatest at the ends, as the initial pressure and pressure due to compression, sets the rings hard against the wall of the cylinder. The vertical wear is somewhat influenced by the alignment of the guides, and I have seen cases in which the wear was very much reduced by a through extended piston rod, properly supported and lubricated.

It is quite probable that a packing ring ½ in. wide wears the upper surface of the cylinder more rapidly and to a greater degree than the ¾ in. and wider ring, but the narrow ring is forced against the cylinder with less total pressure. It has been found with the ¾ in. and wider rings that there is considerable difficulty in keeping them well lubricated. Better wearing results



are obtained with cylinders made of a comparatively hard mixture, using one-half each of good quality pig iron, and old car wheels. Where the saddle is cast separately from the cylinders a softer mixture for saddles can be used to prevent cracked or broken saddles.

Fig. 1 shows a piston head having packing rings ½ in. wide, which illustrates why the upper surface of the cylinder wears more than the bottom surface. As indicated at G there is a space between the piston head and the cylinder wall, and the rings project as at E, while at the bottom the conditions are entirely different, there being a single wide bearing area. Of course, the bottom surface of the cylinder is much more efficiently lubricated, which is a condition in favor of less wear. In a number of cylinders using the narrow packing ring a shoulder was found on the upper surface of the cylinder as shown at X, Fig. 1, which is due to that portion of the cylinder from X to the end of the stroke being passed over by but one packing ring, and therefore wearing only one-half as much. The packing ring also wears more at the top than at the bottom, as shown by Fig. 2.

In cases where it has been desired for the sake of economy to keep in service pistons with grooves ¾ in. and over, very good results have been obtained by turning a groove in the rings, as is shown at D, Fig. 3. The groove can be made any desired depth, and the width is usually made so as to allow ¼ in. bearing on each side of the groove, which gives, in effect, a ½ in. ring. The area in excess of this amount is balanced and the total load pressing the ring against the cylinder, is the area F minus area D.

S. J. D.

Trolley Versus Railroad.

South Bethlehem, Pa., July 13, 1901.

TO THE EDITOR OF THE RAILROAD GAZETTE.

The Lehigh and Lackawanna branch of the Central Railroad of New Jersey is one of the railroads whose passenger business has been greatly affected by trolley competition. This branch is in Northampton County, Pa., from Bethlehem, on the Lehigh River, to Bangor, a slate town at the foot of the Blue Mountain. The distance, as the crow flies, is 20 miles, and by the railroad nearly 25 miles. From the time when the road was built, about 1875, until the present year there have been two daily trains each way which made the trip in 80 or 90 minutes and afforded excellent facilities for the transaction of business between these two flourishing towns. Now, alas, changes have occurred.

Some months ago the slate-belt trolley line was opened for traffic. Starting from Bethlehem, it runs 10 miles north to Nazareth, where three cement plants are now actively at work, thence northeastward through the slate towns of Belfast and Pen Argyl, winding in all directions through numerous roads and streets, so that fully 30 miles have been covered when the Bangor terminus has been reached. On this line trolley cars of the heaviest kind and latest style are run; they are heated and lighted by electricity, equipped with air-brakes and arc-lamp headlights, while the seats are arranged like those of the modern passenger coach and each furnished with an electric button for indicating the desire to stop. Through the beautiful scenery of the Northampton hills these cars, generally crowded, run hourly, making the trip in two hours, or about 30 minutes longer than was formerly required by railroad. The fare, however, is only about one-half as much, and everybody seems to prefer the trolley, so that one of the daily trains on the railroad has been abandoned, while the other one runs at an inconvenient time. A few business men are incommoded, but the public at large seems highly pleased, and people now travel every week who previously did so but once a year.

There is probably not on the face of this earth a more industrious, prosperous and contented peasantry than that which peoples the region between Bethlehem and Bangor. Honest and God-fearing, without being distinctively religious, they live quietly and peaceably on their farms, are thrifty and economical without being miserly, are free from debt, have good habits, healthy bodies, clear consciences and generous hearts. Largely of Scotch-Irish descent they have become German-American in thought, for the Pennsylvania German dialect spread rapidly over the region soon after its settlement and is now the language most commonly heard until the Welsh communities around the slate quarries are reached. During the past quarter of a century the horse and the railroad were the only means by which these people could reach Bethlehem or Bangor. Now comes the trolley line with its low fares and its excitement, and who can say what changes it may work?

It is among the young people of this honest peasantry that the influence of the trolley is the greatest. Especially in the evenings and on holidays the cars are crowded with young men and maidens bound up or down the road for innocent recreation. The modesty and reserve which formerly characterized them has already undergone a change, and a certain excitement is apparent in their conduct. Formerly the refreshment of a glass of beer for the young man and a bottle of soda-pop for the young woman were regarded as the maximum of dissipation. Now higher ideals begin to dawn upon their minds, judging from a conversation recently overheard: "When we get to Nazareth," said the maiden, "I want a bottle of something that costs a quarter; what is it that costs a quarter a bottle, is it champagne?" "Don't you know," said the young man, "that champagne costs a dollar a bottle?"

In its early days the Lehigh & Lackawanna Railroad was sometimes called the huckleberry road, because now and then the conductor would obligingly stop his train to enable passengers to pick that luscious fruit. This was innocent amusement compared to those that the trolley line now affords. That the trolley has its advantages and conveniences none will deny, but the observation of the writer is that its present tendency is to transform the steady, economical and contented peasantry of this region into an unstable, uneconomical and discontented people.

H. E. LICKS.

Fast Run on the Canada Atlantic.

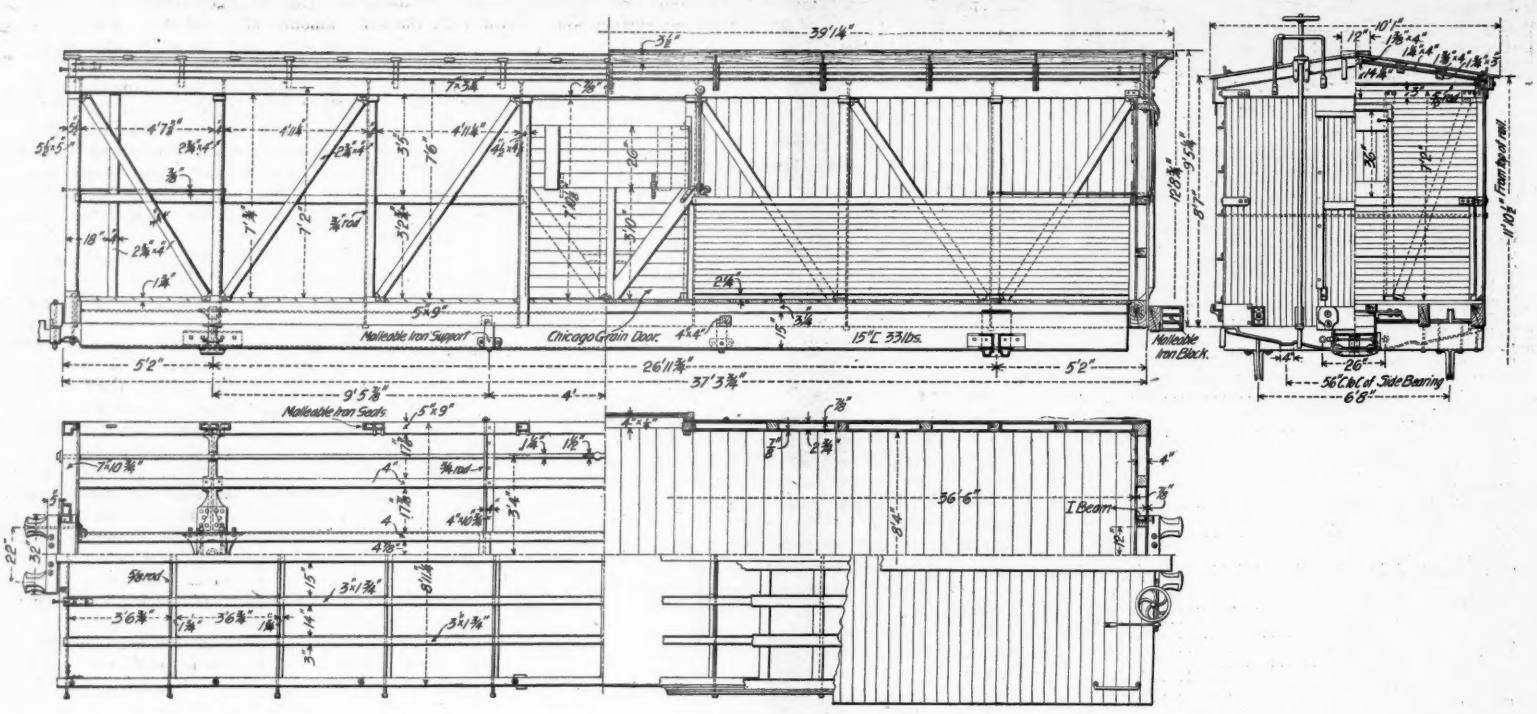
Of the fast run made with a new locomotive on the Canada Atlantic, recently reported in the newspapers, Mr. M. Donaldson, General Superintendent of the road, has given us the following particulars:

This was a trial trip made in accordance with an understanding with the Baldwin Locomotive Works, who had guaranteed that the engine would make a certain speed between Ottawa and Montreal with a standard train of four coaches. The test was made with a four-car train and the Baldwin representative was on the engine.

June 25, engine No. 618, Engineer R. Orr, Fireman T. Angel; mile post 25 to Ottawa. The time for each mile of the run was as follows:

Mile Post.	Seconds.
25	....
24	63
23	56⅝
22	54
21	48⅝
20	43¾
19	48⅜
18	48
17	45
16	45
15	45¾
14	45
13	44¾
12	44
11	41
10	39⅜
9	....
8	48⅜
7	....

The time was kept by the Baldwin representative on the



Box Car With Steel Channel Center Sills, 80,000-lbs. Capacity—Atchison, Topeka & Santa Fe.

engine; by Mr. J. W. Smith, Trainmaster Mehan, Chief Despatcher Lamplough, the conductor and the Superintendent. Mr. Smith and Mr. Donaldson took alternate miles with stop watches, and the conductor took the through run. The time taken by the conductor for the through run varied five seconds from the time by miles taken with the stop watches.

The engine is of the Atlantic type, compound, with cylinders 13½ in. and 23 in. x 26 in.; drivers 84¼ in. in diam.; weight on drivers, 83,000 lbs.; total weight of engine, 160,000 lbs. The engine is equipped with a Pyle National Electric headlight, with electric generator on top of boiler immediately in front of the cab. High-speed brakes are provided for all wheels, including the front truck.

It appears that the time was taken at 16 of the 18 mile posts, and the time occupied in traversing these 16 miles was 12.68 minutes. If the speed for the other two miles averaged as high as for those which are recorded the time for the whole trip was 14.27 minutes, equal to 75.69 miles an hour. The grade of this part of the road is practically level.

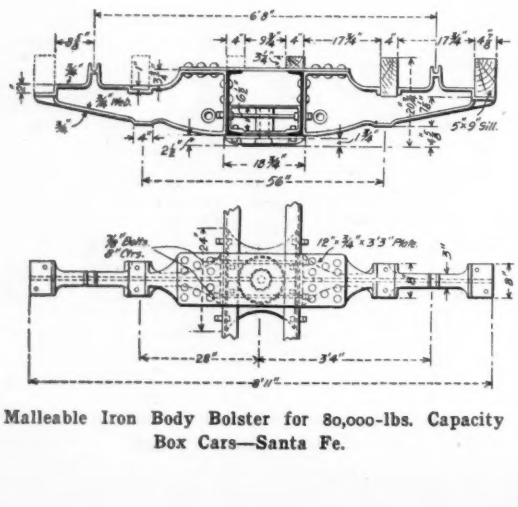
80,000-lbs. Capacity Box Cars of the Atchison, Topeka & Santa Fe.

There are now building for the Atchison, Topeka & Santa Fe 1,600 box cars of 80,000 lbs. capacity from designs prepared by the mechanical department of the road. Of these 500 cars are building by the Mt. Vernon Car Mfg. Co. and 1,100 by the Illinois Car & Equipment Co. The design is shown by the accompanying drawings and photograph, and it is a good example of the use of steel center sills in wooden car construction. The light weight of the sample car is 34,275 lbs.

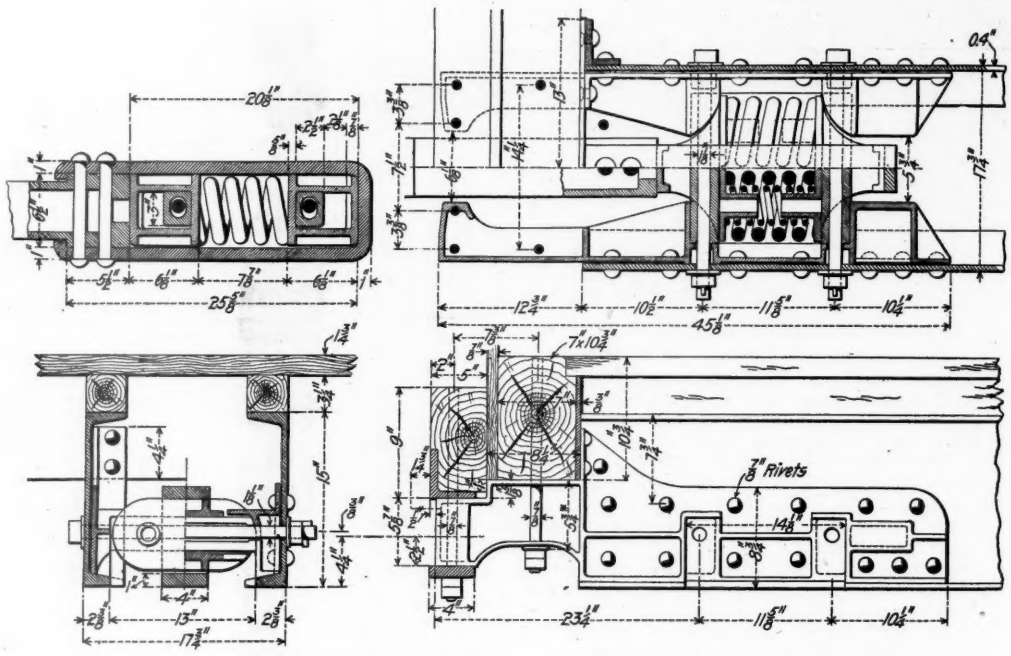
The general dimensions are:

Length over end sills	37 ft. 3¾ in.
Length inside	36 ft. 6 in.
Width over side sills	8 ft. 11¼ in.
Width over siding	9 ft. 1 in.
Width at eaves	10 ft. 1 in.
Width inside	8 ft. 4 in.
Height inside, clear space	7 ft. 2 in.
Height from top of rail to top of running board	12 ft. 8¾ in.
Height from top of rail to eaves	11 ft. 10½ in.
Wheel base of car	32 ft. 1¾ in.
Wheel base of truck	5 ft. 2 in.
Distance between centers of truck	26 ft. 11¾ in.
Distance between cross bearers	7 ft. 8 in.

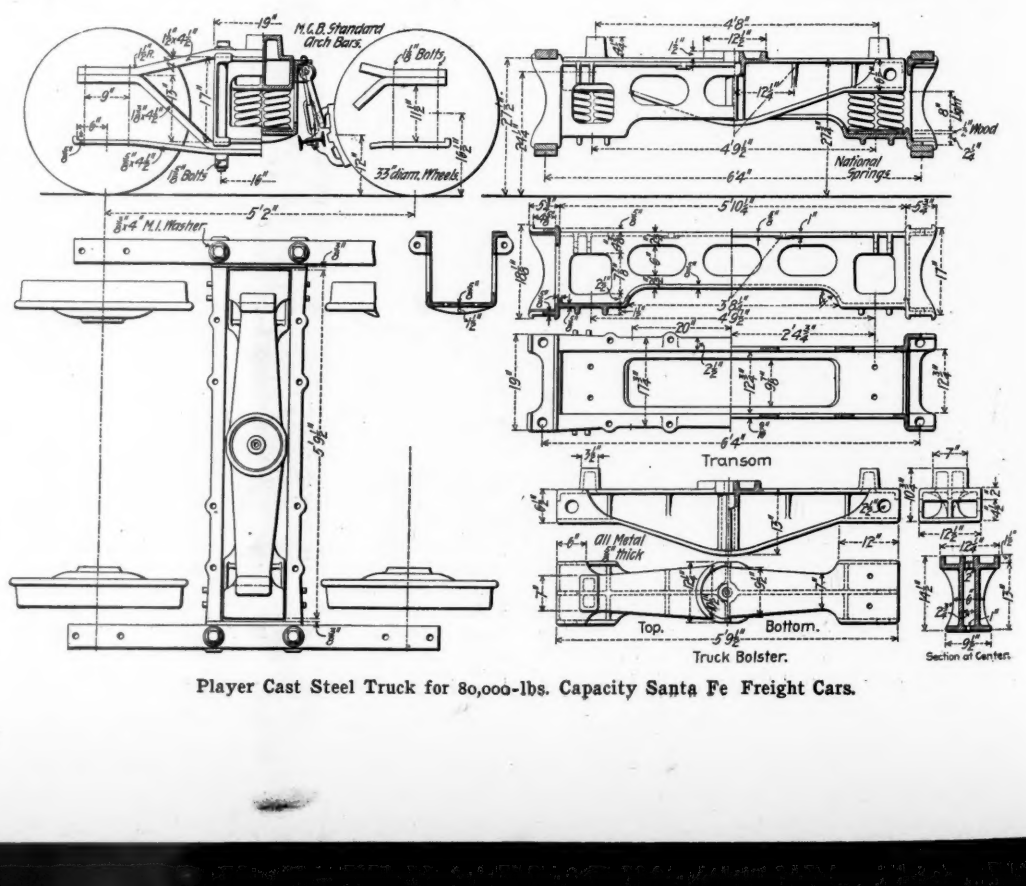
The center sills are two 15-in. 33-lb. steel channels,



Malleable Iron Body Bolster for 80,000-lbs. Capacity Box Cars—Santa Fe.



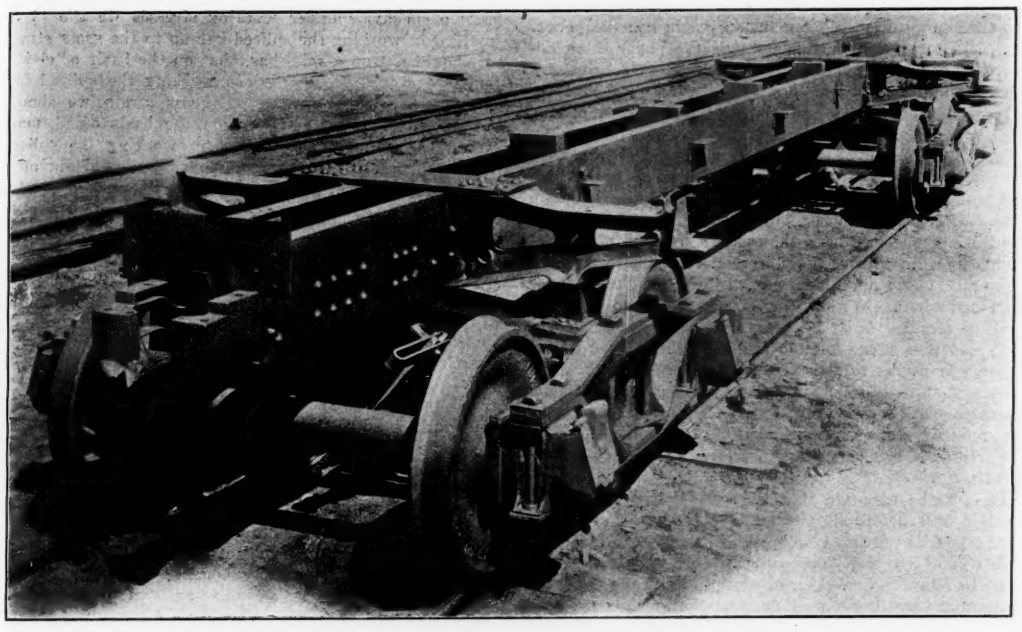
Dayton Draft-Rigging as Applied to 80,000-lbs. Capacity Box Cars With Steel Center Sills.



Player Cast Steel Truck for 80,000-lbs. Capacity Santa Fe Freight Cars.

with 3¼ x 4-in. pine nailing strips bolted to the upper flanges of these sills. The side sills are 5 x 9 in., the intermediate sills 4 x 9 in. and the end sills are 7 x 10¾ in., all yellow pine. There are truss rods, 1¼ in. in diam., between the side and intermediate sills. Oak dead woods are used, 5 x 9 in., and the cross bearers are 4 x 10¾ in., yellow pine, secured to the center sills by malleable iron pockets. The flooring is yellow pine, 1¾ in thick.

The upper framing is clearly shown by the engravings, and it will be noted that malleable iron pocket castings are used in joining the posts and diagonals to the side sills and plates. The four center end posts on these cars are made of 4-in. steel I-beams, 7-lbs. per ft., secured to the end sills by malleable iron shoes. The end braces run from the center sills outwards to the side plates, contrary to ordinary practice; this supports the roof



Steel Center Sills and Malleable Iron Body Bolster for Atchison, Topeka & Santa Fe Box Car.

corners better, and relieves the ends of the side sills from the weight of the roof.

The draft gear on 500 cars is the Dayton twin spring rigging and on 1,100 cars the Miner tandem gear. The application of these draft riggings to the steel center sill construction is shown by detail drawings. Malleable iron dead blocks are used.

The body bolster construction is also shown in detail. The bolsters are built up of two malleable iron brackets riveted to the channels, with malleable iron filler blocks or spacers interposed, but, in order to relieve these rivets from either shearing or tensile strength, an iron strap connects the top of the malleable iron brackets, while they rest at the bottom on projections of the center plates. All rivet holes are punched or cored and afterwards reamed. This is a novel construction suggested by Mr. R. P. C. Sanderson, well known as one of the pioneers in steel car framing. Before deciding upon bolsters of this type a pair of them were made up and placed in the testing machine at Topeka, when it was found that they sustained a load of 60,000 lbs. each before the proportionate limit was reached. The deflection at this load was 0.52 in. During this test the load was applied on the center plate of the inverted bolster, which was supported at the ends, and this is a more severe manner of loading than in regular practice, as the center sills themselves would in actual practice carry most of the load and transmit it directly to the truck without the intervention of the body bolsters.

In constructing the floor framing of these cars a number of difficulties had to be overcome. The spacers between the center sills, as well as the bolster brackets, had to be provided with grinding strips, so that they could be obtained without too much variation. It was found impossible to get channel bars of the length of these center sills sufficiently straight to depend upon. It being impractical to straighten the channels the bolsters were riveted on them as they came, after which the ends of the bolsters on the same side were tied together with iron rods provided with turnbuckles, that were drawn up until the bolsters became parallel with each other and at right angles to the center line of the car. After which these tie bars were taken off, when it was found that the malleable iron brackets had become bent sufficiently to retain their correct position with relation to each other and to the center line of the car, although their angles with the center sills might vary. The center plates are of malleable iron, and of the contour designed by Mr. Edward Grafstrom, Mechanical Engineer of the System.

The "Player" truck, as made by the Shickle, Harrison & Howard Iron Co., is used, which includes M. C. B. arch bars, a cast steel truck transom and cast steel bolster as shown by the detail drawing. The axles are wrought iron with 5 x 9-in. journals which are required to be burnished and polished and conform to the M. C. B. specifications.

The special equipment includes: Chicago roofs, Chicago grain doors, Tower couplers, National springs and Westinghouse air-brakes.

Effects of Splicing and Riveting.*

BY GEORGE S. MORISON, C. E.

The three features which govern the use of steel or iron as structural materials are: The modulus of elasticity (for which it is better to substitute a coefficient of elongation), the elastic limit, and the ultimate strength. Of these, the first determines the behavior of the metal under proper working strains. The two latter determine the limit, which must be put on such working strains, which may generally be taken at from one-third to two-thirds of the elastic limit, and from one-sixth to one-third of the ultimate strength. In tension members the passing of the elastic limit, or, more properly, of the yield point, represents such a distortion of the structure of which these members form a part as to be virtually its destruction. In compression members, a passing of the elastic limit usually means a distortion, which introduces rapidly accelerating tensile strains, which soon destroy the member; the ultimate strength, which is not rupture, but absolute crippling, being little above the observed elastic limit.

There is evidence that repeated tensile strains below the elastic limit will gradually weaken the material; there is no evidence that compression, which tends to compact instead of loosen, has any similar effect. The yield point is generally higher in compression than in tension members, and structures would be more correctly proportioned if based on the yield point for both classes of strains. Furthermore, in the judgment of the writer, in short compression members, a less factor of safety can be used than in tension members. This means larger unit stresses in short compression members than in tension members. The writer believes that many important structures are loaded with unnecessary metal in compression members, and that stronger structures could be built with the same amount of metal if a portion were taken from the compression and placed in the tension members.

In compression members the ultimate crippling is determined by other than compressive strains, the actual stress in a member after it passes the elastic limit being of a complicated character. In a solid, unspliced tension member the strains are of the simplest character conceivable. As soon as splices and irregularities are introduced this simplicity disappears, and complications, whose effects can only be determined by experiment, are introduced. Any such features qualify the ability of the member to change its shape; the coefficient of elongation, the yield point, and the ultimate strength are dependent upon this ability to change shape. The primer of testing recognizes the need of a sufficiently long minimum section to allow the test specimen to drawn down at point of fracture, a short minimum section giving much higher results than a long one, the difference increasing with the ductility of the metal. On this principle, a hole bored in a bar, while reducing its cross section reduces its ultimate aggregate strength to some degree, but materially less than the reduction of the section; the opportunity for the bar to draw down at the point of fracture is reduced, but stretching would occur and be accompanied by an elongation of the hole; if the hole is filled with a rivet, resistance to the elongation of the hole is introduced and this would have some further effect.

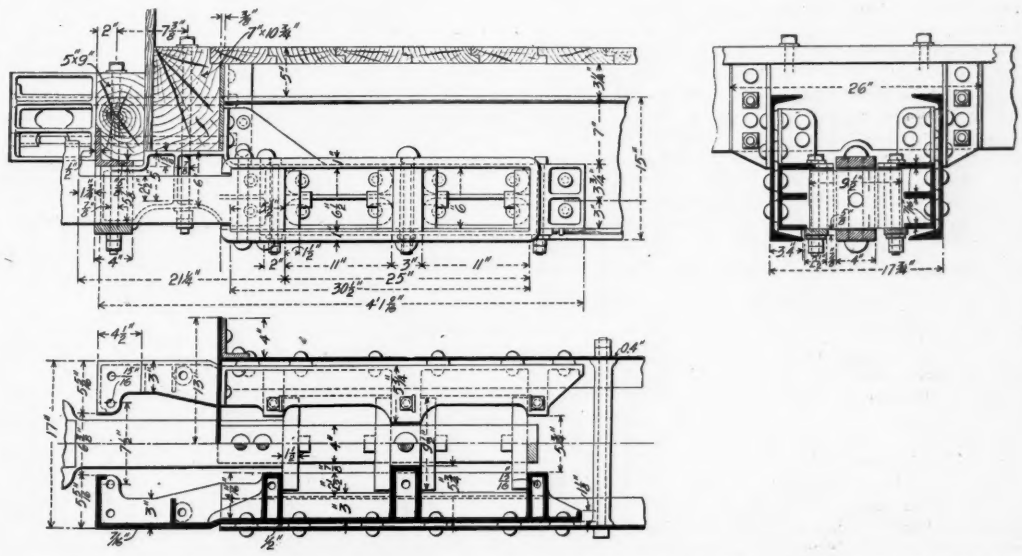
In the writer's practice a case occurred in which it seemed expedient to splice an adjustable tension member by riveting or bolting splice bars on each side. Fortunately the structure had been so proportioned that the unit stress on this member was very low; but before advising this method of splicing, it seemed best to make some actual tests on bars spliced in substantially the manner proposed.

Four bars of soft steel were constructed by the American Bridge Company at its Pencoyd works, two of which were solid bars and two of which were cut in the center and spliced. The details of these bars are shown on the plan which accompanies this paper. In both of the spliced bars the holes were reamed. In one of them the splices were riveted on, and in the other they were fastened with close-fitting turned bolts. The bars were all made of the same steel, the manufacturer's report of which is given in Appendix A.

[None of the appendices referred to in the paper are reproduced by us. The four bars were 16 ft. long each and 4 in. x ⅞ in. The splice bars were 4 ft. 10 in. and 4 in. x ⅝ in. The steel as made at the Pencoyd Works had elastic limit per sq. in. 38,380 lbs., ultimate strength 59,380 lbs., elongation in 8 in. 30 per cent., reduction of area 51.1 per cent., carbon 0.20, sulphur 0.04, phosphorus 0.02, manganese 0.45. The Watertown data are given in the body of Mr. Morison's paper at sufficient length for ordinary purposes. Therefore, the official reports of the Watertown tests are not reproduced.—EDITOR.]

These four bars were all broken in the Government testing machine at the U. S. arsenal at Watertown, Mass., in January, 1901, and a copy of the official report is attached to this paper and is marked Appendix B. The elongations of the several bars under strain in the machine have been plotted, and the curves showing these elongations under strain are given on the blue print attached to this paper and marked Appendix C.

The solid bars broke in the body of the bar under strains averaging 56,915 lbs. per sq. in., one of them showing a total elongation of 14.7 per cent. and a reduction of area at fracture of 53.5 per cent., and the other a total elongation of 18 per cent. and a reduction of area at fracture of 54.7 per cent. Each of the spliced bars broke in the rivet or bolt hole nearest to one of the heads, and showed comparatively small elongation but a large reduction at point of fracture, the elongations being respectively 3.6 and 3.7 per cent., and the reductions 45.6



Miner Draft-Rigging as Applied to 80,000-lbs. Capacity Santa Fe Box Cars With Steel Center Sills.

*A paper presented before the Western Society of Engineers, June 5; printed in the *Journal* of the Society for June, 1901.

and 43.5 per cent. The metal showed signs of overstraining and had begun to draw down opposite the rivet or bolt at the other end of the splice. All this was to be expected, as the full strain was taken here on the section of the bar reduced by the hole. The net section of the riveted bar at the rivet holes, which were 0.94 in. in diam., was 76.5 per cent. of the full section of the bar. The net section of the bolted bar at the bolt holes, which were 0.87 in. in diam., was 78.25 per cent. of the full section of the bar.

The mean ultimate strength of the spliced bars was 46,870 lbs. measured on the original section of the unspliced bar, or 82 per cent. of the mean ultimate strength of the solid bars. The mean elastic limit of the unspliced bars, according to the official reports, was 28,500 lbs., and that of the only spliced bar reported (the riveted bar) was 25,000 lbs., or 88 per cent. of that of the solid bars. A study of the elongations as plotted would seem to indicate that the yield point of the solid bars was practically 30,000 lbs., and of the spliced bars 26,000 lbs., or 87 per cent. that of the solid. All unit stresses are referred to the original section of the bar without allowance for reduction by holes or increase by metal in splices. But the average section of the spliced bars at the hole where the fracture occurred was 23 per cent. less than that of the solid bar, so that the actual stress per sq. in. where the fracture occurred was 6.4 per cent. more in the spliced bar than in the solid bar. The yield point was about 12 per cent. greater. This result is in accordance with those obtained in testing short specimens of ductile metal as compared with specimens of sufficient length to allow full contraction to occur. On the other hand, the form of these test bars allowed a considerable contraction to occur at the rivet or bolt hole where they broke. These results are summarized in the table.

		Stresses Per Square Inch.			Per Cent.	
Number.	Bar.	Ultimate.	Elastic Limit.	Yield Point by Diagram.	Elongation	Reduction.
11,397	Solid	57,730	28,000	....	14.7	53.5
11,400	Solid	56,100	29,000	....	18	54.7
Q	Av. Solid	56,915	28,500	30,000	16.6	54.1
11,398	Riveted	45,640	25,000	....	3.6	45.6
11,399	Bolted	48,100	....	....	3.7	43.5
R	Av. Spliced	46,870	25,000	26,000	3.6	44.5
11,398	Net Section	59,662	32,680	....	...	...
11,399	Net Section	61,472	....	....	...	...
S	Av. Net Sec.	60,567	....	33,592	...	...
	R / Q	82.2	87.7	86.7	...	...
	S / Q	106.4	...	112	...	...

This table shows that the ultimate strength of the spliced bars was about 18 per cent. and the elastic limit about 12 per cent. less than that of the solid bars.

A study of the plotted elongations shows that below a stress of 26,000 lbs. per sq. in., the elongations of the riveted bar were a little less than that of the solid bars, this difference evidently being due to the relief in the center of the bar given by the increased section of the splices. On the other hand, the bolted bar shows a slightly greater elongation than the solid bars, this difference probably being due to the fact that the bolts, though tight, were not an absolute fit, and a slight movement took place around them. The total difference of elongation between the riveted bar and the bolted bar under 20,000 lbs. stress was 0.06 in.

A study of the plotted curves shows some instructive general results. Up to a 26,000 stress the action of all the bars was practically the same, and if we exclude the bolted bar, the action may be said to be identical. After passing the yield point the action of the bars was practically the same until an elongation of 2 in., or 1.25 per cent. of the gaged length, was reached. Above this the elongation of the spliced bars was considerably less than that of the solid bars, the difference being due to the larger section of the spliced portion of the bar.

In spite of the reductions in the elastic limit and ultimate strength, the action of the spliced bars was identical with the unspliced bars under all stresses which would be considered within permissible working limits on an actual structure.

On the basis of behavior under working stresses we should be justified in working the spliced bar up to the gross strain that we should put on a solid bar. On the basis of elastic limit we should be justified in working the spliced bar up to seven-eighths the gross strain we should put on a solid bar. On the basis of ultimate strength we should be justified in working the spliced bar up to nearly five-sixths the gross strain we should put on a solid bar. On the basis of net sections, after deducting for rivet or bolt holes, we should be justified in working the spliced bar up to a unit stress from 6 to 11 per cent. greater than we should put on a solid bar.

A further general conclusion to be drawn is that in proportioning solid beams, like plate girders, it is more correct to use the gross section than the net section. Care should be taken so to arrange the rivet holes as to cut away the material as little as possible, and the limiting strain should be determined after a fair consideration of how much the actual section is reduced; but if the actual net section is reduced 10 per cent. by rivet holes, it is perfectly safe to reduce the permissible gross section strain only 5 per cent. The writer believes the only proper way to proportion plate girders is to treat them as solid beams, and to determine the strain in extreme fibers by using the moment of inertia of the entire beam including the web. Not only is this practice theoretically correct, but it has the decided practical advantage of discouraging the use of thin metal in the webs, thereby producing a girder which is not only well adapted to use, but which will suffer least injury from abuse. Assuming 10,000 lbs. as the strain which would be put on the extreme fibers of such girder if it were a solid rolled beam, it would in almost every instance be possible to design a built beam in which the strain on extreme fibers should be allowed to reach 9,500 lbs. per sq. in. as calculated on the gross section.

Discussion.

Prof. A. N. Talbot, University of Illinois—It is not an uncommon belief that the drilling of a hole in a bar does not reduce the strength of the bar in proportion to the reduction in net cross section, and it is also to be presumed that if the hole is filled with a rivet, the resistance to the elongation of the rivet hole by the rivet will further increase the strength in the net section. It seems fortunate that tests on a large scale to determine the amount of this gain should be made. The writer does not wish to question the conclusion reached in the paper. . . . However, as he understands the paper these deductions can not properly be considered established by the tests made, so far as they are reported in the paper.

It will doubtless be admitted that the stretching of soft steel bars beyond the elastic limit, the elongation of the rivet holes, the distortion of the rivets, and the changed distribution of the stresses among the rivets, give such different conditions that a comparison of the ultimate strength of the spliced bar with the ultimate strength of a solid bar is no criterion of the relative strength within the elastic limit, and hence that the relative ultimate strength cannot be taken as evidence for determining the proper working stress. Within the elastic limit, to compare stresses recourse must be had to the amount of elongation, and this is the method taken by the author of the paper. It seems to the writer, however, that the data presented are insufficient to establish the conclusion quoted above. To determine the effect of the load upon the reduced section, the elongation for a length along the reduced section should receive especial measurement. . . .

It is to be expected that the spliced bar will give a smaller unit deformation than the full bar, since much of the spliced portion is subject to a smaller unit stress. The test of the two bars confirms this, but it does not seem to touch the question of elongation at the end rivet holes, and therefore it does not test the unit stress there. If the weakest link governs the strength of the chain, the unit stress and deformations in the reduced section at the end rivets should be considered and not average values for the gaged length. No measurement of the deformations within the elastic limit at the end rivet holes is given. Nothing, then, seems to be established concerning the stress at the weak point of the bar, the end rivet holes. A similar objection may be made to the process used to find what effect splicing has upon the elastic limit. . . .

The matter under discussion is of importance, and has an application not only to spliced joints of the kind tested, but also to riveted joints and to built sections like plate girders. It has been felt by many engineers for some time that judiciously placed holes, well riveted, do not weaken a piece in tension or compression as much as the use of the net section in the calculation would indicate, and investigations proving this will be of service to the engineering profession. . . .

Mr. Modjeski—I fully agree with Morison in his belief that many important structures are loaded with unnecessary metal in compression members. This is especially liable to occur in members designed to sustain reversals of stresses, the usual practice being to add from 70 to 100 per cent. of the smaller stress to the greater one, and to make the section of the member equal to this sum, divided by the unit strain corresponding to the greater one of the two stresses. As in long compression members the unit strains are generally smaller than in tension members, it results that the foregoing method makes a greater allowance for fatigue of metal in compression than in tension. Mr. Morison justly remarks that "there is evidence that repeated tensile strains below the elastic limit will gradually weaken the material; there is no evidence that compression which tends to compact instead of to loosen, has any similar effect." While it is doubtful to me that the repetition of stresses, in bridge members for instance, is of such character as to weaken the metal, yet if allowance be made for it, this allowance should be greater for tensile than for compressive stresses. . . .

The experiments made by Mr. Morison have been made on bars of one particular grade of metal, of one particular shape and in one particular manner. Furthermore, the drilling of the hole left the section symmetrical. It is evident to me that in order to obtain results sufficiently reliable to lead to a change in general practice of deducting the full section of holes in tension members, we must first have a machine that will break the test pieces in only a fraction of the time which is taken for it now. The critical stresses in structures are generally applied in a fraction of a minute, or often in a fraction of a second. We should have a testing machine, therefore, which could apply the full breaking load gradually but rapidly, and at the same time register automatically the elongation, yield point and ultimate strength. When such a machine is constructed we should make tests on steel of various physical properties, on shapes, bars and plates, on symmetrical and unsymmetrical sections. The lack of symmetry in the sections, such as angles with a hole drilled in one of the flanges, may have a great deal of influence in modifying the yield point. The rapidity with which the stress is applied, the degree of ductility of the metal, may be so many additional factors in determining the exact behavior of the metal and its splices. Not until we have a complete series of experiments on the ideal machine suggested before will we be able to determine the effect of splicing, and not until then will we arrive at the actual factor of safety.

I agree with Mr. Morison that plate girders should be calculated by the moment of inertia, but I have been in the habit of deducting rivet holes by taking the least moment of inertia of the net section.

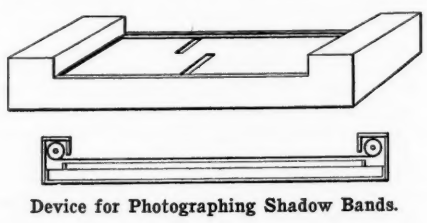
Closure by Mr. Morison.

It is not claimed that the experiments described in this paper give any unexpected or novel information. They are principally valuable as confirming probable results and as adding a little to information already belonging to the profession.

The conclusions reached in the paper, that on the basis of behavior under working stresses we should be justified in working the spliced bar up to the gross strain we should put on a solid bar, that on the basis of elastic limit we should be justified in working the spliced bar up to nearly seven-eighths the gross strain we should put on a solid bar, and that on the basis of ultimate strength we should be justified in working the spliced bar up to five-sixths the gross strain we should put on a solid bar, are only approximate conclusions, but are believed to be sufficiently close to absolute accuracy to justify following them in practice. It is admitted that the refinement of extreme accuracy might give somewhat different results. The practical application drawn from the first of these three is that in a riveted member the gross section may be used in determining the moment of inertia by which the member is to be proportioned. The practical application from the other two conclusions is that in determining working stresses, the stress on extreme fibers allowed for a built up section should be less than for a solid rolled section. The practice of the writer for some years has been to proportion all plate girders by the moment of inertia of gross section; to fix the limiting unit stress in extreme fibers for solid metal; and to reduce this stress in built members in proportion to the amount of metal removed by the rivet holes in the extreme flanges. In the case of girders with cover plates this reduction is easily determined; in the case of girders without cover plates a somewhat arbitrary rule must be followed, the idea being to make an allowance for rivet holes in the connection of the flange angles with the web corresponding to that made for rivet holes in cover plates and horizontal flanges of angles, if they exist. These experiments indicate that this allowance is larger than necessary.

Photographing the Sun's "Shadow Bands."

A definite addition to astronomical knowledge has been made by the eclipse party sent to Sumatra from the Massachusetts Institute of Technology, in the photographing of the mysterious shadow bands which have puzzled astronomers ever since eclipses have been scientifically observed. The measure of the success obtained will not be definitely known for weeks to come, or until a full report of the results of the development of the photographic plates can be transmitted by letter. Meanwhile the brief cipher cablegram which was received in Boston by President Pritchett after the eclipse occurred seems to give unmistakable evidence that some of the plates had



Device for Photographing Shadow Bands.

already been developed sufficiently to indicate that photographs of real value had been secured. Prof. Alfred E. Burton, who is in charge of the expedition to Sumatra, has as his associates Mr. George L. Hosmer, of the Civil Engineering Department; Mr. Harrison W. Smith, of the Department of Physics, and Mr. G. H. Matthes, a graduate of the Institute, now in the United States Geological Survey. The members of the expedition, while planning astronomical observations, were particularly well equipped to study the physical problems dependent on the eclipse, and in every way, indeed, to extend the scope of their observation by means of the most modern methods of applied science.

Heretofore, shadow bands have been observed only visually. Visual observation, however, is always an unsatisfactory method of determination, and the reports of observers have often been so contradictory as almost to cast a doubt upon the existence of any real phenomenon. As these bands of light and shade were first observed on the walls of buildings or upon white sand, so the first step toward recording them was made by means of a sheet spread on the ground, upon which sticks were placed to show the direction of the shadows upon the sheet itself and the direction of their movement from it. As a slight advance on this method long strips of canvas have been marked with black lines to facilitate visual measurements of the bands, or sticks painted in alternate colors have been employed, while an assistant has sometimes run with

the shadows in order to furnish a comparative standard for estimating their velocity. All the theories regarding shadow bands have heretofore been merely speculative. Prof. Pickering (observations at Grenada, 1886) reported that some of the bands which he observed were six feet long and some of unknown length, that some of them moved at the rate of six miles an hour, some with the speed of an express train, and some in an undulating fashion with the velocity of a gale of wind. According to his theory, the bands were caused by some refraction of the atmosphere resulting in visible differences in the distribution of light.

During the eclipse of Jan. 1, 1889, Mr. Winslow Upton observed at Willows, Cal., shadow bands an inch in width and three or four inches apart, and apparently stationary, but an endeavor to photograph them proved a failure, although the conditions were unusually favorable to the attempt. In recent eclipses long dark bands separated by light spaces have been seen, more or less distinctly, moving rapidly on the ground or on sides of buildings just before and after totality, but even at the eclipse of May 28, 1900, observed by practically the same party which is now in Sumatra, they were noted only visually, and no photographic results were reported.

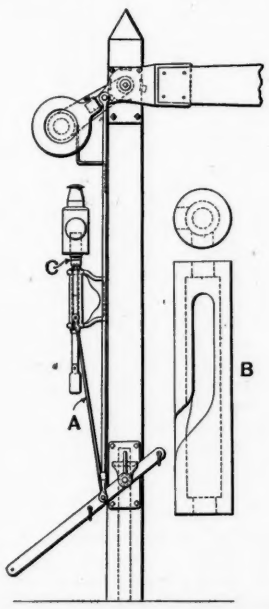
The method which Prof. Burton has doubtless employed in Sumatra—the method, that is, which was planned by Mr. Harrison W. Smith before leaving Boston—is precisely opposite in its principle to the old method. The new plan is actually to expose a sensitive photographic plate to the bands themselves—letting the bands fall upon it, that is, in place of endeavoring to photograph the bands as they appear upon a screen. It was proposed to use a shutter of the form of the Thornton-Pickard focal plane shutter. In the preliminary experiments two ordinary curtain rollers were fixed at the end of a light wooden frame with an opaque curtain stretched over the rollers to be rolled up on one roller, and when released wound up rapidly on the other by means of a spring. This curtain contained a slot and was stretched directly above a sensitive plate. When the curtain was released, therefore, the slot was drawn rapidly across the plate, which was then exposed to whatever light happened to be falling on the apparatus. If the intensity of the light in Sumatra varied sufficiently from point to point to produce visible bands, it would appear that the bands ought to be recorded by this apparatus on the plate. Again, by having two slots in the curtain, one traveling across the plate just after the other, the velocity of the bands could be determined, the speed of the shutter being known, since the bands on the opposite halves of the plate would not join, but would appear displaced relatively to their velocity, and that of the moving curtain.

Two pieces of apparatus placed at an angle of 90 degrees would record the bands whatever their direction might be, and if the records obtained in Sumatra are as intelligible as the plan of the apparatus would presume, astronomers will have for the first time in history accurate data for scientific study of this particularly puzzling phenomenon.

Wrigley's Signal Lamp.

As heretofore noted in the *Railroad Gazette*, the Erie Railroad now has in use a large number of semaphore signals in which the color of the indication from the lamp at night is changed by a rod separate from that which works the semaphore arm, the lamp revolving on a vertical spindle, and the spectacle in the blade casting being omitted. The construction of this signal is shown in the accompanying drawing, which, however, shows a model which was made for exhibition, and not a signal which is in service.

The drawing needs little explanation. The rod *A* moves upward whenever the signal is moved to the go-ahead position, and the pin in its upper end, sliding in a straight vertical groove, revolves the lamp by engaging with the spiral groove in the piece which supports the lamp. This spiral groove is shown at *B*, which is an enlarged detail. The lamp turns a quarter turn, so as to show the glass which is at right angles to that which appears in the cut. The lamp is fastened to its support at C by an adjustable joint which allows the lamp to be turned at an angle when necessary, as in cases where the signal is approached by a sharp curve.



Wrigley's Signal Lamp Connection.

The object of Mr. Wrigley's invention is, of course, to avoid the necessity of using two glasses over each light, as is necessary where a semaphore spectacle, several inches from the lense in the lamp iself, is used to give to the light the desired color.

Wrigley's Switch-Stand.

Mr. J. Wrigley, of Elmira, N. Y., has devised and patented a simple ground switch-stand, which is now in use at a number of points on the Erie road, and which is shown in the accompanying engravings. As will be seen from Fig. 1, the lever when at rest lies parallel with the track, and the principal moving parts are protected from the weather by a cast iron cover. The mode of operation will be understood from an inspection of Fig. 2, the crank which moves the switch rod being actuated by a spiral groove cut in a cylinder. The portions of the groove at the end, which are cut at right angles to the axis of the cylinder, serve to hold the switch locked in either position. This locking section of the groove can be omitted at either end, so that the switch can be made automatic in both directions, or locked in both directions, or automatic for the side track and self-locking for the main line. The top of the target spindle is only 17 inches above the top of the tie. The bed plate is only 9¾ in. wide, so that a single tie suffices for support. There is no gearing in any part of the machine.

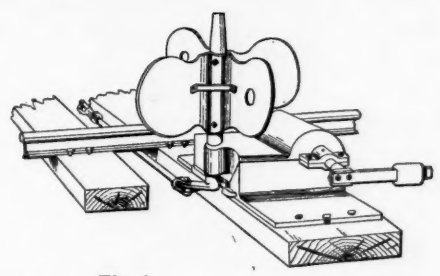


Fig. 1.

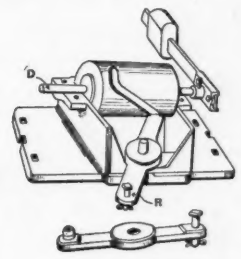


Fig. 2.

Wrigley's Switch-Stand.

The stand is so designed that it can work a detector bar if desired, the connection being made at *D*. This stand is made by the Elmira Heights Foundry & Machine Company, Elmira, N. Y.

Interurban Electric Railroads.*

And this leads us to the greatest problem before the interurban railroad engineer, viz., How to provide the average rural district with the advantages of rapid transit and still bring to the investor a fair and proper return for his money. From the official reports from the State of Massachusetts we learn that the average cost of a mile of electric railroad in that State has been as follows:

Roadway and track	$23,433.43
Car equipment	8,510.13
Electrical equipment	11,683.82
Total	$43,627.38

It is proper to state that these figures include both urban and interurban railroads. We have many examples of the latter, however, averaging about as follows:

Roadway and track	$10,000.00
Car equipment	2,000.00
Electrical equipment	8,000.00
Total per mile	$20,000.00

The well-constructed urban lines are operated on 55 to 60 per cent. of the gross earnings, but the interurban roads are running higher, say 66 per cent.; although as earnings increase we may expect a corresponding decrease in this percentage. At this rate the gross earnings must be $3,000 per mile of road to pay interest. Most of the roads already built will earn this or more, but we must remember that the best territories are now occupied and our operations in the future must be in fields not so inviting, because the population is less dense. In this connection it may be interesting to note that the latest official reports of the operations of the electric railroads of Ohio, New York and Massachusetts show the following gross earnings. For the fiscal year ending June 30, 1900, 960 miles of urban railroads of Ohio earned an average of $10,193 per mile and 390 miles of interurban roads earned $3,824 per mile; while the average gross earnings of all the electric railroads, both urban and interurban, was $8,354 per mile, against $10,452 for Massachusetts and $24,445 for New York. In the latter state the urban railroads earned $29,613 per mile and the interurban $4,727 per mile.

It seems unwise to undertake to build a less expensive roadbed and track for the growing exactions of the traveling public; rather does the keen competition of the steam roads compel us to provide good alignment, easy grades and a perfect track. It is a generally recognized fact that a high-grade roadbed and track is absolutely necessary if maximum earnings and minimum expenses are to result, and in this connection we unhesitatingly recommend securing a private right of way whenever it is possible so to do. As with the road bed so with the car equipment. We cannot safely economize in its cost, therefore power and power transmission seem to present the only chance we have for reducing the cost of construction.

In the generation of power and the transmission of the same I am satisfied that our mechanical and electrical engineers have been devoting their attention more to the efficiency of the service and the economy of operations than to the minimizing of first cost. It is true they are embarrassed by the absence of competition due to the formation of trusts and combines controlling machinery and materials, but this in time will regulate itself. I believe, however, there is much which can and will be done in the near future in the way of reducing first cost of power and its distribution. If we are to serve the average rural district as we would it is absolutely necessary that economies in first cost shall be introduced. Just what form these will take it is difficult at this time to prophesy; whether it will be compressed air, the storage battery, or the familiar trolley with four motor equipment we do not know. One thing is certain. We cannot serve the rural districts fully until we can give them first-class transportation service with a smaller expenditure of capital.

To increase the earnings is a different problem. To the writer the volume of earnings of some of the existing lines is a constant source of wonder, and he confesses to having mentally prophesied failure in a number of cases where success has attended the actual operations. It is a singular thing how business is actually created where there was promise of little or none by supplying facilities which the public has never felt the need of. It seems the denizens of the rural districts are quick to realize that it is cheaper to send the women on their shopping trips by the trolley than to withdraw horses and a driver from farm service.

Up to this time practically all the earnings have come from passenger business. In the future we may look for a big source of revenue from freight. Already many of the lines are establishing regular freight service. The telephone in connection with the trolley freight permits of quick deliveries and the merchant and his customer will not be slow to take advantage of it. Recently an enterprising inventor has put out what he terms a "rail wagon," which gives promise of being a good thing for the interurban railroad and its patrons. Briefly stated, this wagon is intended to run between the farmyard and the city warerooms. It is provided with four standard car wheels for rail transit and with four additional wheels with broad tread adapted to highway travel. Its capacity is about six tons and is so constructed that any product of the farm can be conveniently and quickly transported to the nearest market without breaking bulk. At the simple and inexpensive transfer sidings provision is made for minimizing the dead load for animal power by cutting out the rail trucks, so that two or four horses can move the wagon to and from any portion of the farm depending on the condition of the roads.

*Extract from an article by Mr. Walter J. Sherman, C.E., in the Transactions of the Association of Civil Engineers, Cornell University.

Commission Rules for the Inspection of Safety Appliances.

The Interstate Commerce Commission adopted a set of rules in April last for the guidance of its inspectors, which are of interest in showing how this work is intended to be carried on and what the Commission considers defects. These rules have been printed in pamphlet form.

The first rule requires that the inspector shall make himself known to the officer in charge previous to examining the equipment and invite him or his representative to accompany the inspector. When so accompanied the inspector shall draw attention to all dangerous defects. The second rule requires that a report be made, giving the location of all curves in yards and sidings where M. C. B. couplers will not couple or remain coupled; also the practice generally followed where such curves exist and whether any special device is used in coupling at these points.

Rule 3 relates to air-brakes in general. Information is required in reference to the practice of handling brakes on descending grades and to what extent hand brakes are used; further as to what inspection is given air-brake cars upon leaving terminals and whether enginemen are informed of the exact number of air-brake cars with effective brakes. Inspectors are cautioned to see if air-brake defect cards are attached to cars and if repairs indicated by these cards are promptly made; whether special attention is given in making up trains to put the

air-brake cars at the forward end of the train and whether heavily loaded cars, sagging in the middle, have leaky train pipes.

Rule 4 covers other safety appliances. Special attention is required to be given to grab irons on the roofs of cars and reports should say whether they are secured with lag screws or bolts, and to a substantial part of the car frame. Inspectors are asked to observe closely new cars and those out of the shops a few months for loose handholds and grab irons, and to report all defects found in running boards and ladders, whether constructed of iron or wood. Other sections of this rule are: "Report as to the results of the use of pivotal couplers on locomotives assigned to switching. Note to what extent men have to go between cars to couple them during the making-up of trains. Also, to what extent men step in to open or close knuckles by hand. This should be ascertained by careful observation. State whether locomotives are equipped with M. C. B. type of coupler, noting if on end of tender only or on tender and front end. State fully all particulars of any other than the M. C. B. type of coupler found on coaches or cars of all kinds. Note on report of defective cars whether the inspection was made prior to an inspection by the railroad's inspector, and, if possible, show disposition of cars found defective."

The following are listed as defects to be reported:

DEFECTS OF HANDHOLDS.

1. Broken coupler body.
2. Broken knuckle.
3. Broken knuckle pin.
4. Broken locking pin or block.
5. Bent locking pin or block.
6. Wrong locking pin or block.
7. Wrong knuckle pin.
8. Worn locking pin or block.
9. Worn couplers or knuckles, as per M. C. B. limit gage.
10. Short guard arm.
11. All missing parts of coupler complete, except cotter pins in knuckle pins.
12. Inoperative locking pin or block.

Note.—Nos. 5, 6 and 7 are defective only when interfering with safe operation.

Nos. 8 and 9 are defective only when worn sufficiently to destroy contour line by allowing lost motion to approach the danger point as shown by M. C. B. limit gage.

DEFECTS OF UNCOUPLING MECHANISM.

21. Broken uncoupling lever.
22. Broken chain.
23. Broken end lock or end casting.
24. Broken inner casting or keeper.
25. Bent uncoupling lever.
26. Chain too short.
27. Chain too long.
28. Loose end lock or end casting.
29. Loose inner casting or keeper.
30. Wrong end lock or end casting.
31. Wrong inner casting or keeper.
32. Uncoupling lever improperly applied or of wrong dimensions.
33. Missing uncoupling levers, and locks or end castings, inner castings or keepers, chains, clevis or clevis pins.
34. Chains kinked, making them too short.

Note.—No. 25 is defective when interfering with its proper operation or making it difficult to operate.

Nos. 28 and 29 are defective when the proper operation of the uncoupling mechanism is interfered with.

Nos. 30 and 31 are defective when interfering with proper operation of uncoupling lever to the coupler for which it was designed.

No. 32. Under this head report all uncoupling levers which are too long, too short, too close to cars or other parts; give details to each.

Judgment should be used in connection with the defects under No. 32.

DEFECTS OF VISIBLE PARTS OF AIR-BRAKES.

41. Defective triple-valve casting.
42. Defective reservoir casting.
43. Defective cylinder casting.
44. Defective cut-out cock.
45. Defective release cock and broken release rods.
46. Defective angle cock.
47. Defective train pipe (broken or loose).
48. Defective cross-over pipe.
49. Defective hose.
50. Defective hose gasket.
51. Defective brake rigging, beams or brake shoes.
52. Defective retaining valve.
53. Defective retaining-valve pipe.
54. All missing parts.
55. Air-brakes cut out; when possible give reason why.
56. Whether cylinder or triple valve has been cleaned in six months preceding.
57. Whether locomotives moving interstate traffic are equipped with driver brakes and appliances for operating train brakes.

Note.—Defects Nos. 41, 42, 43 and 48 are such as ordinarily only exist after cars have been wrecked, but are mentioned here to define the defects of visible parts.

DEFECTS OF HANDHOLDS.

81. Handbooks missing.
82. Handholds improperly applied.
83. Handholds bent.
84. Handholds broken.
85. Handholds loose.

Note.—Application of handholds and grab irons should be governed by recommended practice of the M. C. B. Association. A standard location for these parts is essential for safe operation at all times and especially at night.

DEFECTS IN HEIGHT OF DRAWBARS.

91. Empty cars too high.
92. Empty cars too low.
93. Loaded cars too low.
94. Loaded cars too high.
95. Loose carrier iron or stirrup.
96. Bent side sill step.
97. Loose side sill step.
98. Broken side sill step.

Note.—On standard-gage roads the maximum height is 34½ in., measured from level of tops of rails to the center of the drawbar (coupler body) or corresponding line in coupler head. Greatest variation allowed from such standard height between drawbars of empty and loaded cars is 3 in. On narrow gage roads the maximum height is 26 in.; extreme variation allowed between drawbars of empty and loaded cars is 3 in. Inspectors must exercise judgment in determining defects of this class. See that car is standing on an approximately level track before measurements are taken.

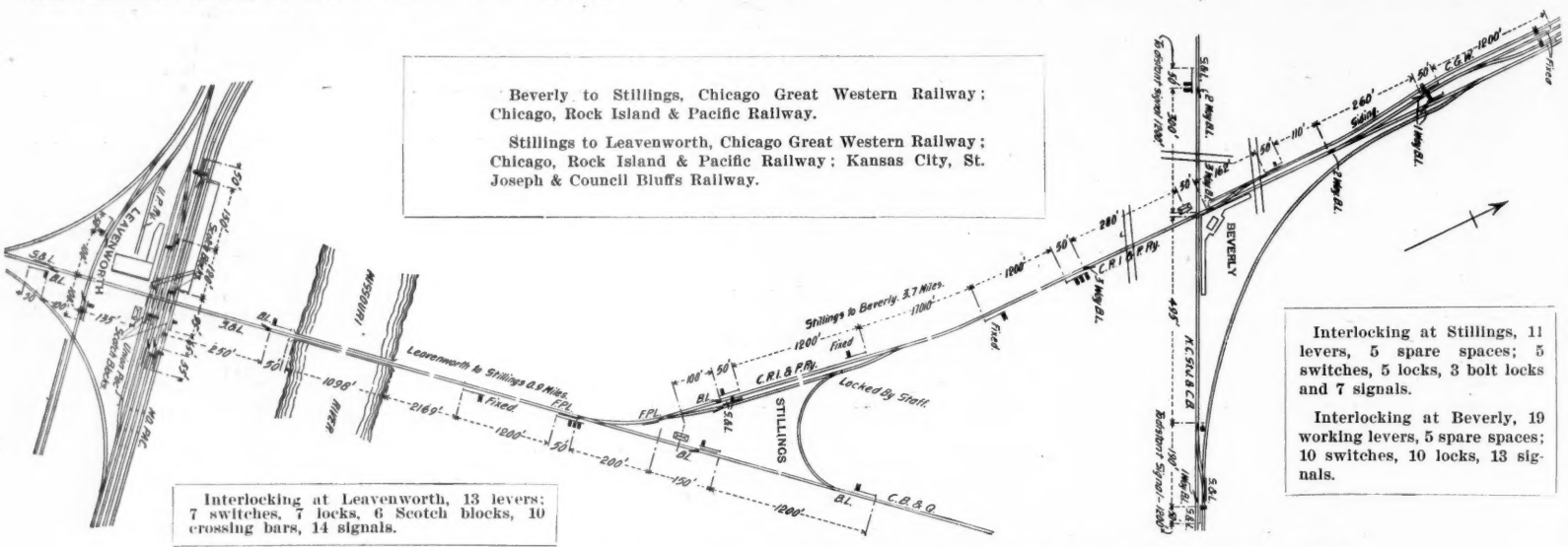
Minimum height for loaded or empty cars, standard or narrow gage, is 31½ in. An empty car having a drawbar 31½ in. high is defective because when loaded it must fall below the minimum of 31½ in.

The Electric Train Staff at Leavenworth.

The Union Switch & Signal Company has lately received orders from a number of railroads for its improved electric train staff apparatus, and this method of running trains on single track appears to be growing in favor. In view of this fact a description of one of the most recent installations of the train staff apparatus will be of interest, and we give herewith a diagram showing two sections of railroad which are thus worked, one of the sections being used by the trains of two railroads and the other by those of three. The names of the railroads are shown on the drawing, together with brief notes of the interlocking at the stations. Both the interlocking and the staff apparatus were made and put in by the Union Switch & Signal Company, of Swissvale, Pa.

Beverly to Stillings, Chicago Great Western Railway; Chicago, Rock Island & Pacific Railway.

Stillings to Leavenworth, Chicago Great Western Railway; Chicago, Rock Island & Pacific Railway; Kansas City, St. Joseph & Council Bluffs Railway.



Interlocking at Leavenworth, 13 levers; 7 switches, 7 locks, 6 Scotch blocks, 10 crossing bars, 14 signals.

Interlocking at Stillings, 11 levers, 5 spare spaces; 5 switches, 5 locks, 3 bolt locks and 7 signals.

Interlocking at Beverly, 19 working levers, 5 spare spaces; 10 switches, 10 locks, 13 signals.

Two Sections of Railroad Worked by the Electric Train Staff; Beverly, Mo., to Stillings, Mo., and Stillings, Mo., to Leavenworth, Kan.

As the reader doubtless knows, the electric staff is a device for giving to a train the absolute right of way over a section of single track. The staff is a steel pipe, 22 in. long, stamped with the names of the stations between which it is used. Without a staff no train can leave the station at either end to pass over the line. A supply of staffs is kept in a magazine at each end, and, by the use of electrical interlocking between the magazines at the two stations, the withdrawal of a staff at either station, for use by a train, locks the instruments so that it is then impossible to withdraw another staff at either station until the one taken out is returned either to the place from which it came or to the magazine at the other station.

It will be observed that the drawing is not made to scale; and sections of track are cut out to make it possible to show the principal features at the three stations within the space available on a page. The distance from Beverly to Stillings is 3.7 miles, and from Stillings to Leavenworth a little less than one mile. On the first named section the number of trains is about 36 daily, and on the other about 90.

A staff to be delivered to a train is placed in a crane similar to a mail crane, as on the Chesapeake & Ohio, and where a staff has to be thrown off from a moving train a catch box is provided, filled with cinders. Most of the enginemen, when taking a staff, reduce speed to about 10 miles an hour, though some of them take it at much higher speed.

Usually there are more trains westward than eastward over this line, so that every one or two months the surplus of staffs has to be taken out of the pillar (magazine) at the western end of each section and carried to the pillar at the eastern end. The machines have a permissive staff, but thus far it has not been found necessary to use this feature.

Superintendent C. B. Stembel, of the Chicago Great Western, who is in direct charge of the lines shown, says that the staff has given perfect satisfaction. The apparatus has never been out of order, except in what may be called the experimental stage, when it was first put in, and it never causes any delay to trains.

The operator or signalman at Stillings is the chief staff operator, and decides, when necessary, which of two trains ready to start at or about the same time shall take precedence in the use of a section of road.

The lever working the signal which admits a train to the section of road controlled by the staff is locked by a key fixed to the staff; so that until the staff is taken out of the pillar it is impossible to give a clear signal for the train to enter the section.

It will be observed that at Stillings Junction there is a switch which is not connected to the interlocking cabin. This switch can be opened only by the staff.

Between Beverly and Stillings, to provide for possible failure of the staff apparatus a special form of train order, called "staff 31," is prescribed. A train order on this form states that the staff apparatus has failed, and it gives to the train which receives it absolute right to a certain station.

The Westinghouse Electric Brake and Heater.

In our issue of June 28, pp. 449 and 466, appeared an account of the interesting brake lately brought out by the Westinghouse Air Brake Co. It will be remembered that this apparatus includes also a very ingenious mode of heating by the electric current. Concerning this latter feature we have some more detailed and elementary information which will perhaps be interesting to those who are not very familiar with electric street car apparatus.

The manner in which the braking and starting currents are used for heating the car with the Newell brake apparatus is as follows:

In any motor car a set of resistances, called diverters, is connected up with the controller operating the car, in such a way that when the motorman turns the controller handle he first admits the current through a large amount of resistance causing the motor to start gradually, and as the handle is turned farther and farther portions of this resistance are cut out until, when the car is under full speed and handle turned to its extreme positions, the motors are in direct connection with the current from the trolley line. With the Newell brake equipment, the ordinary set of diverters is replaced with a special set so arranged as to maintain a uniform resistance regardless of rise in temperature, which is not the case with the ordinary diverters, and in addition to this the car is also provided with a duplicate set of diverters made up in a form so as to be conveniently installed inside the car—usually under the seats—and designated as "heaters."

These heaters contain the same resistance as the diverters underneath the car and may be connected with the controller either partially or as a whole by means of a three-point switch placed so that it may be readily operated by the conductor, but out of reach of passengers. The operation of the car in starting is exactly the same with this arrangement of diverters or heaters as with those ordinarily supplied.

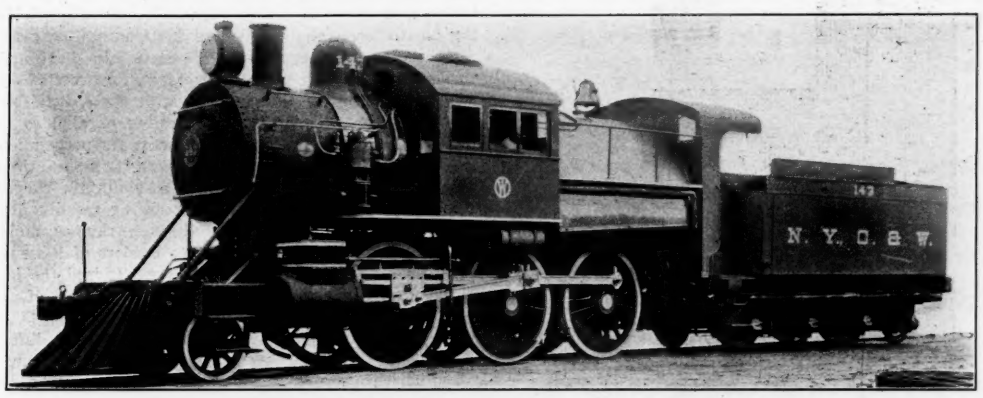
When braking, the car motors are, by means of a suitable arrangement, connected up in such a way as to act as generators driven by the motion of the car, generating electricity which is thrown through the diverters or heaters, as the case may be, finally reaching the brake magnets. The diverters or heaters in this case are used to limit the amount of current which would otherwise flow through the brake magnets, these magnets being so designed as to require only a small amount of current, the remaining energy developed by the car motors acting as generators being converted into heat in the heaters or diverters, depending upon which is thrown into action. The heaters are, of course, used in whole or in part in cold weather, and the diverters when the weather is too warm to require any artificial heat within the car.

Heat is obtained not only from the current produced by the car motors acting as generators, but also from the trolley-line current, which is necessarily transformed into heat in starting the car.

A New Mogul for the New York, Ontario & Western.

The accompanying illustration is from a photograph of engine No. 143, of which there is thus far but one to represent the class, the latest type of mogul used on the New York, Ontario & Western. This engine is a modification of engine No. 139 and class, to which we referred in our issue of Jan. 18 as having been equipped with a third bearing, designed by Mr. George W. West, Superintendent of Motive Power, and placed on the driving axles. There were also shown in that issue complete drawings of this third bearing journal, and its attachments. Herewith are drawings showing modifications made by the Cooke Locomotive & Machine Company and approved by Mr. West, for applying this bearing to engine No. 143, the object being to simplify and cheapen the application. The differences in detail may at once be seen by reference to the drawings previously published.

Engine No. 143, which was delivered by the Cooke Locomotive & Machine Company on April 10, was designed



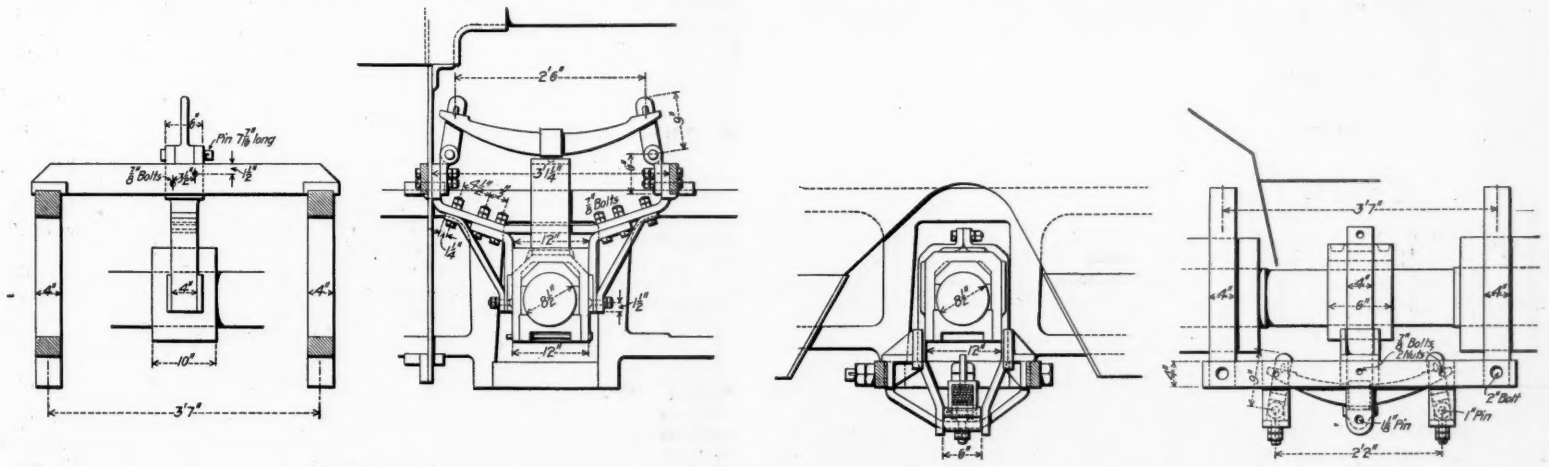
The New York, Ontario & Western's Latest Mogul.

to pull heavy passenger trains in the summer and milk trains in the winter. It is apparent that the engine has not been in service long enough to demonstrate its working qualities, and we are informed that no more engines of this class will be built until it is learned what service can be obtained with the heavy passenger trains in the summer season. The cylinders are 19½ in. x 28 in., the weight on drivers 134,000 lbs., the weight on engine truck 17,000 lbs. and the total weight of engine in working order 151,000 lbs., the loaded weight of the tender being 102,000 lbs. The driving wheel base is 13 ft. 9 in., the total wheel base of engine 22 ft. 9 in., and the wheel base of engine and tender 49 ft. 7½ in. The driving wheels are 69 in. in diameter outside of tires, and have cast steel centers 62 in. in diameter. The engine truck wheels are 36 in. in diameter and have cast iron centers with steel tires. The driving axle journals are 9 in. in diameter and 11 25/32 in. long. The engine truck axle journals are 6 in. diameter and 9 15/16 in. long.

The boiler is the straight top radial stayed type with wide fire-box above the frames and the working steam pressure is 200 lbs. per square inch. The thickness of boiler shell is 11/16 in., and the diameter of the first course 69⅜ in., the horizontal seams being sextuple riveted. The fire-box is 120 in. long and 96 in. wide, the grates being combined shaking bars and water tubes. There are 333 tubes 2 in. in diameter, No. 12 W. G., and 11 ft. 4 in. long over flue sheets, giving a heating surface of 1,959.61 sq. ft. in the tubes, and there are 159.48 sq. ft. in the fire-box, making a total of 2,119.09 sq. ft. of heating surface, the grate surface being 80 sq. ft.

Richardson balanced valves with Allen supplementary ports are used, the greatest travel being 5⅞ in., the length of steam ports being 18 in., and the width 1⅝ in. The exhaust ports are 3¼ in. x 18 in. and the exhaust pipe is medium high with single nozzle and petticoat pipe. The boiler has the extended smoke-box. The height of the center of boiler from rail is 9 ft. 4⅜ in., and the height from rail to top of stack is 15 ft. ⅝ in.

The tender has a 10 in. steel channel frame with Fox pressed steel trucks and chilled cast iron wheels 33 in.



Main Axle. *Back Axle.*

Improved Third Bearings for New York, Ontario & Western Mogul.

Maintenance of Telegraph Lines and Offices.*

The satisfactory working of a telegraph line depends upon a multitude of apparently small details. With iron wire the joints should be particularly looked after. The twist joint, soldered, is the best, and it is well to go over the line and solder the joints every three years. This will save battery power and save time in operating. With copper wire the joint should be the MacIntyre two-sleeve joint or the three-wire joint. Copper joints should not be soldered and iron tie wires should not be used with copper wires. The glass insulator appears to be good enough for ordinary American lines, but along the coast Mr. Lockwood thinks perhaps good porcelain insulators—not the door-knob kind—would be worth trying. A water pipe is preferable to a gas pipe for a ground connection. If a gas pipe is used, connect on the street side of the meter and choose a comparatively small pipe in preference to a very large one. Connect to the pipe with as large a copper wire as you can get. Where there is no pipe connection, drive an iron bar into the ground where you are sure of dampness. Never use bare wire in offices. Never use oil cloth covers on operating tables. Lightning arresters should always be examined after a flash and crack, even if the wire is not completely grounded. Be careful to have all relays of the same resistance, especially when reconstructing a line or adding new offices. Never allow the armature of a relay to touch the magnet cores; adjust by the spring and not by moving the magnet. Where residual magnetism makes trouble transpose the main wires. Every operator at a way station should be able to make any desired combination on the switchboard and to intelligently clean the local battery. With porous cups the zinc should be blocked up by a piece of wood so as not to touch the cup. This will prevent the formation of copper incrustations. If paraffine for the tops of gravity batteries costs too much, common tallow will answer for the purpose of preventing evaporation. Sometimes a Leclanche cell will fail because the porous cup is stopped up; in such cases an iron needle stuck into the holes, so as to let the gas out, will often make the battery work.

There should be some systematic means of instructing young operators so that they can learn all these things beforehand instead of being obliged to rediscover them, each for himself.

*Abstract of a paper by Thomas D. Lockwood read before the annual meeting of the Association of Railway Telegraph Superintendents.

A Railroad President's Work.*

The President, perhaps, has just returned from a trip to New York, where he has attended a conference of Presidents of allied lines. He has been on the road all night, but, thanks to that business-like institution, the private car, often erroneously considered a luxury, he appears in his office fresher for work than the suburbanite who has just come in on the commuters' train. While the President is looking over his personal mail, word spreads about the big building that "the old man is back." Gradually the private secretaries of the different chiefs drop into the outer office to learn from the President's private secretary what business is most likely to come up first, and what chance there is for action on some pet measure. The bell rings, and for a few minutes the private secretary is closeted with the President. Daily telegraphic reports have kept the President informed of events on the line, but in a surprisingly brief time he learns of smaller happenings, of messages left by prominent callers, and of the general behavior of his child, the railroad.

Then the President sends for the General Manager, and learns officially some of the things the private secretary has told him as gossip, and many others of greater moment, but perhaps of less real interest. The half hour with the General Manager may mean a number of things: it may be decided to move the company's shops from Dan to Beersheba; it may be decided to extend the Utopia branch, which means a fortune to investors in land beyond Utopia, and ruin to some in the old terminus. The President may tell the General Manager that the demand for a dividend on the preferred stock is becoming more clamorous, and that they must get along another year without the 5,000 new box cars that are badly needed, and the building of which would affect many idle men. The President very likely calls the attention of the General Manager to the Auditor's estimate of last week's earnings, and asks why expenses cannot be reduced just a little more. The President reminds the General Manager that the contract for hauling Chicago dressed beef is conditional upon a second morning delivery at the seaboard two hours earlier than that previously given by a rival line. He also observes that the reliability and regularity of the passenger trains is helping the Western tourist business, that the delay to the hotel men's special by a freight wreck last week will hurt the winter travel to California, and that the new dining car must be made to pay expenses. He asks why the ton-mile cost of moving freight has not decreased in proportion to the recent outlay for big engines. He ventures the opinion that the Superintendent of the Slowburg division must have been asleep while the City Council of Ringville passed an ordinance requiring the company to erect ten more electric lights at street crossings. He expresses polite astonishment at the failure of the passenger department to book the headquarters train for the next Grand Army encampment. He makes no attempt at concealing his disgust over a competitor's securing ten trainloads of agricultural machinery for the Western prairies. He then takes up the question of a larger terminal charge for switching cars to connecting lines, and suggests to the General Manager that the revenue would be increased by more favorable terms in the next contract with other roads.

The General Manager, who has taken all this in the Pickwickian sense in which it was intended, now has his turn. From the bundle of papers under his arm he draws a condensed estimate of an elaborate plan for reducing the cost of transportation on a certain division by running around a bluff and locating freight yards near a busy river, instead of climbing into the town. The trained eye of the President catches the salient points, and he tells the General Manager whether or not funds are likely to be available, whether or not it is politic to antagonize municipal or other interests. The General Manager diplomatically shows the President that the New Orleans cotton traffic is suffering because of the President's order to consider all Minnesota flour as rush freight. He asks authority to increase the pay of a Superintendent who has a better offer from another road. From the bundle of condensed reports he shows a saving of 100 tons of coal the previous week by reason of better fuel furnished from the new mines. He tells of a new gasoline engine at Pumptown which will cut in two the monthly bills for water supply for locomotives. He reports a conference with the Mayor of a big city about the smoke nuisance near the freight yards. He opines that the President's last visit to the State capital has killed the Populistic Legislature's bill for granger rates. He suggests that it would be well for the passenger department to stop promising dollar excursionists a two-hour schedule for a hard three-hours run. He urges conciliatory measures toward the City Council of Buck-

*From an article by Charles de Lano Hine in the *Century Magazine*.

town, which will repeal the speed ordinance as soon as the old morning accommodation train is restored, and "Number Six" (the St. Louis express) can then get through the town on time. In the most nonchalant manner he asks to be excused, that he may catch a train leaving in five minutes, as he has an appointment for the next morning some 600 miles away.

Before the General Manager has finished, the private secretary is entertaining two or three reporters of afternoon papers. The President sees them, comes out, shakes hands, and tells them rates are to be stiffer than ever; that the stockholders are tired of hunting snipe for the fun of holding empty bags. He then asks them for news about his road, as he has been in New York helping his wife do her shopping.

An Experience with Good Boiler Water.

Mr. Henry Miller, Assistant Superintendent of the Burlington Route, at Hannibal, Mo., presented a short paper at the June meeting of the St. Louis Railway Club, which shows the effects of good water on locomotive performance. Mr. Miller says in part: Two locomotives of ordinary standard type are used in daily passenger service between Hannibal, Mo., and Burlington, Iowa, on the Burlington Route. These engines ran 12,120 miles each during the month of May just past, and are now doing the work formerly done by four engines. They are kept in almost continuous service without being cooled down, are only washed out twice a month making over 6,000 miles, which is extraordinary, and seems to be very near the ideal condition for engine service.

This performance was made possible by the discovery that at a regular water station our engines were being supplied with a fine quality of water produced by a new process of filtration. By equipping these engines with large tanks, they were enabled to perform the service required by taking most of their water at the station above mentioned, and at one other place where the water is fair. These engines are giving almost perfect service; there is no flue trouble, no foaming or other difficulties, and the plan thus far has proved entirely successful. It has also enabled a good showing to be made in passenger mileage on the St. Louis, Keokuk & Northwestern because in one month nearly 72,000 passenger miles were made by seven engines, averaging 10,271 miles each. This shows the importance of good water at a single station.

At another place on the same division a switch engine is located which used to go to the shop once a week to be washed out, involving a 38-mile run. We found we were getting good water there, and inquiry of the boiler-washer as to how much solid matter was found in washing the boiler, brought the response that there was very little. This showed that we were simply going through the motions of washing out when there was no real necessity for it. The method was changed at once, and the engine now only goes to the shop once every month or six weeks, when other work is necessary. This is an example of what good water will do, and it is instructive, because it is so seldom that a railroad can avail itself of such improvements without costly experiments or the expenditure of large sums of money to get results. I relate these experiences because I think they may interest roads that happen to have the same conditions water. It seems to be one thing to get good water and another to take advantage of it.

The Greenbush Collision.

The New York State Railroad Commissioners have made a report on the butting collision on the Albany & Hudson (electric) Railroad, May 26, when five persons were killed and over 80 injured. The case was investigated by Commissioner Baker and Electrician Barnes. Both of the motormen were killed. As heretofore reported in the *Railroad Gaeztte*, the collision was primarily due to the carelessness of the motorman of southbound car No. 34, in running past the side track where he should have met northbound car No. 38. The Commissioners, however, hold that the conductor was, in a measure, responsible for running past the meeting place. It is customary for the first car arriving at a meeting station to take the side track. The approach to the station where the stop should have been made (Siding No. 69) is straight for half a mile. Mr. Barnes' report, which is indorsed by the Commission, says:

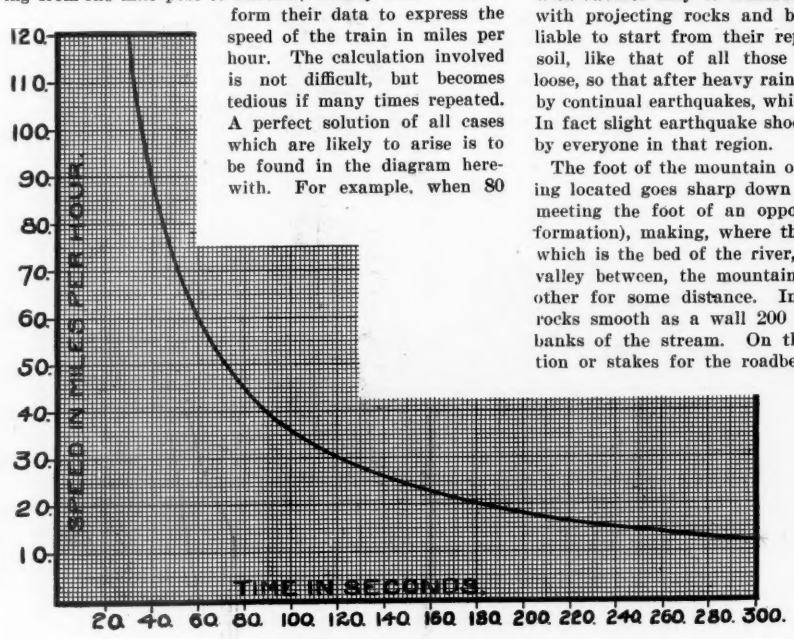
"Conductor Johnson should have been on the lookout to see whether car No. 38 was on the siding or not, and if it was not he should have been prepared to go ahead and throw the switch at the north end of the turnout to allow his motorman to take the siding, and should not only have been on the lookout for this purpose, but also to see whether car No. 38, if it was on the siding, was carrying signals or not. Had he been on the lookout approaching the north end of the switch, and his motorman did not slow up approaching it, and he had pulled the bell at the north point of the switch, his car would then travel 908 ft. before it reached the point of the accident. This, running at 40 miles an hour, would have taken 15.4 seconds. If, however, as is very probable, Motorman Smith had forgotten about meeting, and had been reminded of it by the signal on the bell at the north point of the switch, he would have immediately applied his emergency air, and in this way the speed of the car would have been reduced, if it was not stopped, before the collision occurred."

The Commission finds that the management of the road was good, except that meeting orders are sent on form 19, not requiring signatures; it is recommended that form 31, requiring signatures, be used; also that the cars of the company be equipped with some means to enable the conductor to shut off the current and apply the air-brake from the rear of the car.

The coroner who investigated this accident found that the railroad company did not use proper care and discretion in employing new men for conductors and motormen.

Seconds Per Mile and Miles Per Hour.

Travelers who enjoy observing the time occupied in passing from one mile post to another, usually seek to transform their data to express the speed of the train in miles per hour. The calculation involved is not difficult, but becomes tedious if many times repeated. A perfect solution of all cases which are likely to arise is to be found in the diagram herewith. For example, when 80 seconds are required in passing from one mile post to another, the speed of the train as shown by the diagram is 45 miles per hour; if the same distance is passed in 50 seconds, the rate of speed is 72 miles per hour.



Seconds Per Mile and Miles Per Hour.

The Guayaquil & Quito Railway.

The passage from New York to Guayaquil, the principal port of Ecuador, takes about 14 days. The New York and Panama Steamship Co.'s ships leave New York every Tuesday, reaching Colon on the Isthmus the Tuesday following, and generally in time for the train going to Panama on the Pacific side, a distance of 43 miles, in about three hours. Guayaquil is reached in about four days from Panama by Pacific steamer, for which you may wait two or three days in Panama. It is on a river of the same name about forty-two miles from the ocean.

The railroad starts at a station called Duran on the opposite side of the river, which is about a mile wide. There is only one train a day which leaves at 9:30 a. m. and arrives at Bucay about 6 p. m. This road is a metre gage and 57 miles long, single track, and was built some twenty-five or thirty years ago. From the end of this line the present company propose to continue their road on to Quito, about 300 miles more. I understand this old line was formerly called the Quayaquil & Quimbo Railway. It now stops two miles short of Quimbo, which is at an elevation above the sea of 1,100 feet, more or less. It passes through a belt, which produces the chocolate and cocoa and has some large plantations of sugar cane.

Just beyond Quimbo is the permanent camp of the railroad company, which is reached by hand-car on the old line. The camp consists of about 30 houses of wood some 100 ft. long or so, with balconies running round, others smaller in a sort of villa style, permanently and well built, with corrugated ridge roofs, covering house and balcony and quite luxurious for that part of the world.

From the time of the acquirement of the road and its privileges, the present company proceeded to continue the line to Quito, intending to make it single and of the same gage as the old line, but most unfortunately about a year ago all the work they had done up to that time had to be abandoned, owing to a defect in the location, and they resolved to start again *ab initio*. Since that great misadventure they have been and are now locating the line as rapidly as possible. In fact there are also some pieces of embankment for roadbed constructed in favorable spots near the river Chang-Chang from 100 ft. to one-half mile or so long and from five to six feet in height.

To get up to any part of the proposed line from the company's camp there is only one way either by mule or horseback. Any baggage or materials can only be carried in the same way, and it is therefore absolutely impossible to bring rails or any other heavy material up the line for construction till the continuation of the old road. The trail for the most part runs near to a rapid torrent, the Chang-Chang, which runs at the base of one of the numerous mountain ranges or spurs. It is formed by the snow melting from the summits of the higher Andes, its beds and sides being composed of boulders which roll down from the mountain, the water dashing and boiling with an uproar that can be heard several hundred feet away.

Some 10 or 15 miles from Chimbo the trees begin to give out and the mountains to assume a savage appearance, and where the greater difficulties of construction will begin to show themselves, indeed within the next 50 or 60 miles, the ground is very difficult. Take, for instance, to Pistishi or onward, which is a type of the formation in that region—a precipitous mountain—scored with ravines fifty to hundreds of feet deep and rugged with projecting rocks and boulders of enormous size liable to start from their repose at any moment. The soil, like that of all those mountains, is friable and loose, so that after heavy rains boulders and rocks shaken by continual earthquakes, which appeared firm, roll down. In fact slight earthquake shocks can be felt almost daily by everyone in that region.

The foot of the mountain on which this railroad is being located goes sharp down to the Chang-Chang river, meeting the foot of an opposite mountain (a frequent formation), making, where they meet, an inverted apex, which is the bed of the river, with, at spots, little or no valley between, the mountains running parallel to each other for some distance. In some parts perpendicular rocks smooth as a wall 200 to 1,000 ft. high form the banks of the stream. On the east mountain the location or stakes for the roadbed are being rapidly placed through ravines and on the borders of lofty precipices. Indeed the locating parties boast of using ropes as long as 200 ft. to suspend the different members in locating or driving stakes where the road is to run.

The grades laid down are up to 5 per cent. and specially 5½ per cent. The curves are up to 30 deg., and in special cases 35 deg., which means a rise of 5 ft. to 5½ ft. every 100 ft. and that the road may curve 29 deg. to 35 deg. every 100 ft. The road is to be located from 300 to 500 ft. above the Chang-Chang in some places—and even with the above grades the cut and fill will be enormous, as the levels show. The length of the curves will average from 150 to 300 ft.; the tangents much less in many places. I understand the company stands all losses from slides in the construction or other such cause, so the contractors are safe. W. H.

Ecuador, June, 1901.

Signaling a Railroad.

BY GEORGE W. BLODGETT.

The signal engineer who does not have an unlimited supply of money at his command has constantly before him the problem how to spend what is available for signal equipment to the best advantage. There are various ways in which a definite amount of money, which may be quite limited in proportion to what could wisely be spent, may be laid out. It may be expended as the State of Massachusetts builds its highways, on what may be called the apportionment plan; that is, a certain portion of the road where signal protection seems to be most necessary may be chosen, and the whole sum be spent in equipping as thoroughly as possible this small section, leaving the remainder of the road, for the present, wholly without protection, and to be dealt with at another time. This will undoubtedly put this portion of the road in the best possible condition, but the total neglect of the remainder is likely to leave it in a deplorable state of insecurity.

It is, therefore, an important question whether there will not be a great gain in dividing the money between several points where protection is urgently needed, spending a little here and there to secure the most dangerous places, or those where there is most traffic, and thus diminish as much as possible the danger of accidents at the points where they are most likely to occur, and taking other portions or other points in the order of their relative importance or the urgency of their need. This is the line along which it has seemed to the writer most profitable to work, and which has given, in his own experience, most satisfactory results. To carry out this plan most successfully, however, demands a thorough study of the requirements, present and prospective, of the whole road (or at least the whole of the division where the work is to be done), in order that whatever is undertaken may be intelligently carried out; so that it will not be found necessary later to abandon or relocate work which has cost considerable money. How little rearrangement or change will be necessary depends on the thoroughness with which the details of the general scheme have been considered in the preliminary plans, and how accurately future requirements have been forecasted.

From this point of view several things ought to be considered; and first, what will satisfy the reasonable needs of present traffic, as if it alone was to be provided for; then the probable increase of business; from what points it will arise, and at what intervals or under what arrangements the extra train service must be furnished; the increase or rearrangement which may be necessary in the signaling apparatus as provisionally located. The

plan adopted should provide for present needs, and for future growth in the same scheme.

Provisional locations, and numbers or other designation of the signals can be determined as a part of the general scheme, also the interlocking which may be ultimately necessary at each point, may be provisionally determined. It is not worth while to go into minute details of work which is not soon to be put in, as track and other changes are likely to render a large portion of that labor unavailable. A quite thorough *preliminary* study, sufficient to fix upon the main features of each installation, can, however, profitably be done at each place where interlocking will be required. We may then do each year whatever portion of the work circumstances make possible, and we need have no fear that it will be obsolete or unavailable when the whole of the scheme is carried out, however long the delay may be.

In pursuance of this plan the principal junctions and yards may be equipped with interlocking in the order of their importance; sections of the road may be furnished with line block signals; particular points may be provided with detached signals; and outlying switches may be protected as means will permit; any or all of these things can be done simultaneously or consecutively, and when the gaps are filled, all the work will be found to fit together like the joining of the spans of a bridge which is being erected each way from the piers and the abutments at the same time.

Such a plan of the line block signaling of a certain railroad throughout its whole length was worked out in this way by the writer some years ago, and has been followed towards completion since that time; and only in one or two insignificant instances have changes from the originally selected locations of the signals been found necessary. It has usually not been found necessary even to change the numbers of detached signals put up in accordance with this plan.

A profile of one division of the road, which may be taken as a type of all, is shown herewith. The order in which the automatic signals called for by this plan were erected, is shown by the dates affixed to each. It is necessary to go upon the ground, and take account of the local features of each case, to get a satisfactory understanding of why the particular order followed was found to be the best, but some notes of explanation will perhaps make the matter clearer.

The stations on this division in the order of their relative importance are Springfield, Pittsfield, Chester and Westfield. Springfield is the starting point of a large number of freight trains, and a junction point with three other railroads. Two miles east of Pittsfield is the junction of a branch road doing considerable freight business; also it is the end of a run for freight trains east and west, being at the bottom of a long and steep grade. Going east nearly all freight trains are obliged to take helpers. Between the junction and Pittsfield, westbound freight trains are sometimes obliged to stand in line because of the inability at that time to get past Pittsfield station. To protect these, three automatic signals extending over nearly three miles (the most easterly of these protecting also the junction itself), were put up.

On the other side of the mountain a somewhat similar state of affairs exists at Chester, except that there is no junction; also certain local trains run back and forth between that station and the east.

Three signals west of the station and one east were placed here in 1887. A dangerous facing point switch at Middlefield was furnished with a signal in 1886, and still better protection was provided by a distant signal a mile farther back the next year. Later still the switch was taken out and put in facing the other way, in a more favorable location. Station block signals were provided for the other stations, and outlying switches on this division were protected at the dates attached to the signals, taking first those cases where there seemed to be the most urgent need as far as funds were available, and especially those points where there was a down grade approaching the station. Later those on the upgrade were taken, this last to protect the trains standing at the stations, and to show at a distance when the switches were being used. Later all of the steepest down grades were provided with continuous block signals; and the last work that has been done was equipping portions of the line where there was a moderate down grade. There still remain some places on up grades which are not yet furnished with continuous blocks; but since the trains run slowly and it is easy to stop them when going up the grade, there is very little danger of rear end collisions on this portion of the road. It is expected, however, that they will be taken care of when the more important work has all been done, and there is a sufficient sum available. What was done on this division is a type of the way in which every other was treated.

The plan here outlined is not of course the only one that may be followed, nor does the writer claim that it would be in all cases the best, but it has worked well in his own experience, and he does not know wherein he could have better arranged it for the purpose he had in view.

As regards the use of interlocking, it seems to the writer that if there is not money enough properly to furnish with interlocking all the points that need it, more real benefit will be obtained for what is spent, by selecting a few points where it is most needed and fully protecting these, than by partially equipping a larger number, but not finishing completely the work at any point. By partial equipment is meant, furnishing signals and connections for the most important train movements and the most frequently used switches, like the main line work and the principal connections at a junction and leaving the less important movements and the switches more seldom used at the same junction to be operated by hand.

The writer believes that this course is very likely sooner or later to lead to disaster, because the control of the whole of the traffic at the point in question is not in the hands of the signalman, as it should be, but only that part of it which is connected with the tower.

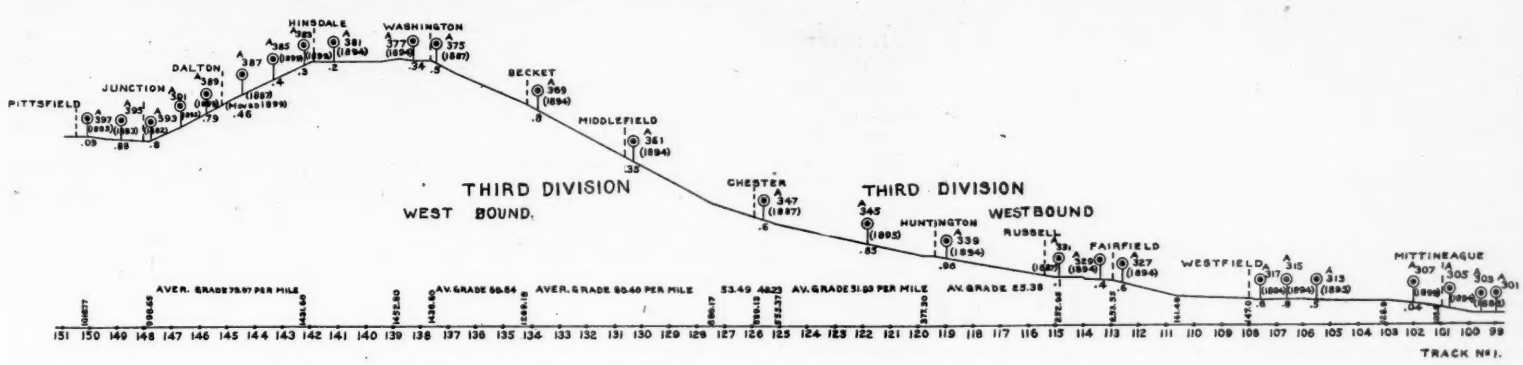
Some further portions of the interlocking may be governed by the towerman, although not operated by him, by the use of bolt locks or similar devices by which the operation of hand switches is prevented, except when the towerman gives permission; but this has its limitations, and the writer believes does not give perfect satisfaction. There is a divided responsibility, and in case of trouble each of the parties concerned wants to throw the whole blame on the other.

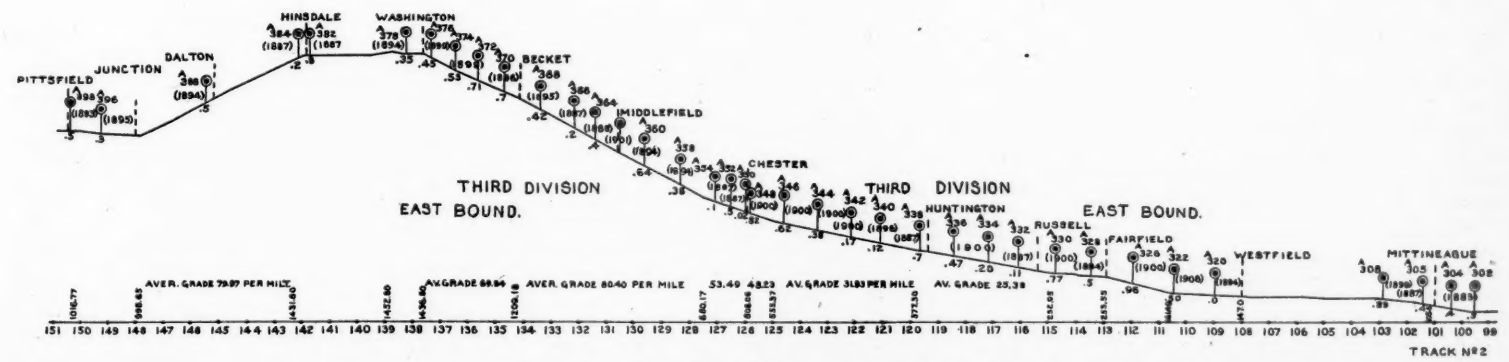
Much delay is caused when only a part of the switching apparatus is connected with the tower, because of the time required to take the precautions necessary for safety when any part of the apparatus not operated through the tower is to be used. The writer thinks, therefore, that it will always be found preferable to provide interlocking for all the movements of a few really important points, than to partially equip a larger number of places without perfectly protecting any point. If this idea is carried out, we may feel secure that as far as signalling is concerned, we have provided as well as possible for the rapid and safe handling of traffic at the places designated, and have not left open some loophole for a collision or derailment because some switch which must be operated by hand was not in proper position, or the towerman did not think that it was to be used.

Where there are line block signals and also interlocking, the writer has found it good practice so to arrange the line block signals as to furnish the most complete protection possible, in nearly the same way as would be done if the interlocking did not exist; that is, he intends the line block signals should always show whether or not the line is clear to the next block signal, although interlocking signals located between may show whether or not the train can pass a particular point in that block. Hence where rail circuit signals are used, it is the writer's practice to make the track circuit continuous right through the district controlled by the interlocking. He thus makes the automatic signal of a block show at all times whether the track is or is not occupied, or the switches set for the route to which that signal belongs, while the interlocking signal shows whether or not the towerman will allow the train to pass. This differentiation of function he believes to be the true one, and if the distinction were always kept sharply in mind, there would not so often be confused ideas of the value and the limitations of automatic block signals. The writer thinks they should be strictly limited to show the state of the track, whether or not it is continuous, and whether or not it is occupied by a train (for, since track circuit signals can detect broken rails, they have an additional and very important duty beyond that relating to the protection of trains); and whether switches are set for the main line or otherwise; while the interlocking, which can show only the latter of these things, has its own place in allowing or forbidding the train to proceed past some particular point.

The writer would treat the warning given by an automatic signal showing danger, exactly the same as if given by a flagman, viz.: If the train is stopped at all it should be no longer than just sufficient to show that the warning has been heeded. This may be done by bringing down the train to a certain speed slow enough to insure its being under full control, and then proceeding as the way is seen to be clear. The danger in this latter case is that it either leaves the determination of the proper speed to the judgment of the engineer, or that his obedience to the rule may be only partial; and there is usually no check on his action; but if the block signals properly overlap each other, and the engineers are under proper supervision, the writer believes it safe to adopt a rule requiring only the slowing down of trains at automatic signals showing danger, except in some particularly important case. This would dispose of one of the principal arguments against the use of automatic signals, by those who disbelieve in them, that a signal out of order causes a serious delay to a train and often exposes it to the danger of a rear collision by a following train on account of a stop for a certain definite time at a signal showing danger.

Used in this way automatic and interlocking signals are complements of each other, each having its own definite purpose, and carefully distinguished in its functions from the other, and filling a place that could not be done by either kind alone.





Automatic Signals on the Third Division of the Boston & Albany.

RAILROAD GAZETTE

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PUBLISHED EVERY FRIDAY
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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

Reports of damage to the corn crop in Missouri, Iowa, Nebraska and Kansas have been somewhat conflicting during the past week. The early reports of drought led to a rise of four to six cents a bushel in the prices of all grains at Chicago, but within a day or two these prices fell back nearly as much as they had risen. On Wednesday of this week, however, the *Journal of Commerce* (New York) published a page of telegrams from the States named which, summarized, show that a damage of 50 per cent. to the corn crop in a large part of the States named would be a very moderate estimate. The *Journal of Commerce* says that the worst damage is within a circle of about 600 miles in diameter, with St. Joseph for its center. Live stock losses are also severe in Missouri and Kansas; and farmers are selling stock for lack of fodder. The estimated loss in corn means a diminution of 312 million bushels, as compared with last year's crop. The telegrams published are mostly from bankers and other conservative men.

The action of the American Railway Association, at its last meeting, in the matter of large freight cars is already bearing fruit. This is as gratifying as it is novel. In consequence of the well known conservatism of this association, and its entire lack of authority, most of its decisions heretofore have simply confirmed decisions which the railroads had already made, individually. The result to which we now refer is the action of the Pennsylvania Railroad in designing 2,000 new box cars, as recorded in another column of this issue. We have already noted, in a previous issue, the action of the roads in Trunk Line and Central territory in revising the minimum weights to be charged for carloads of bulky articles carried in cars of large cubic capacity. These changes effected considerable advances in many kinds of goods, and there was at once a good crop of vigorous objections from shippers, followed, according to newspaper report, by a weakening on the part of some of the roads. The stiffening of the tariff, however, was evidently based on definite orders from executive officers, who realize the importance of the problem and who mean to do their best to carry out the recommendations of the A. R. A. Committee; so that we may expect that those natural-born rate cutters who at once set about nullifying the advances which were made in the tariffs, will be closely watched by their more conservative competitors. So radical a change, with such insidious difficulties to be expected at every step in carrying it out, may well require repeated attempts before it is definitely settled; but we may hope that a large number of strong roads will now give attention to the matter. In building box cars to carry 55 tons (everybody loads ten per cent. more than the car is marked) the Pennsylvania people were, no doubt, strongly tempted to make the cars long and high, and thus make them available for a greater variety of commodities; but such availability is only a temptation to the freight agents to cut rates, and the Pennsylvania, evidently, has determined to give to the A. R. A. Committee both moral and practical support.

Draft Gear Tests.

The M. C. B. committee in its report to this year's convention says: "It is the intention to make draft gear tests early next summer. The convention is asked for a free discussion of this question of draft gear tests." Unfortunately at the meeting someone started to talk about the percentage of car repairs due to draft gear and little was said after that about methods of testing.

For the present it may be assumed that the subject of chief interest to the draft gear committee is the question of tests. From the remarks of the chairman it would seem that a preliminary plan will be outlined shortly and this will be presented at a joint meeting of the members of the committee and the draft gear makers, when a working plan will be agreed on. In the meantime such discussion and suggestions as are presented by Mr. Clark, of the Chicago, Burlington & Quincy, in a contribution to this journal, will doubtless be very acceptable. Every one realizes that this committee has a big task before it and it needs the co-operation of every one interested in the subject. Mr. Clark describes a method of testing draft rigging which has not been used so far as we know.

It will occur to any one who has thought about this work that a good deal of tact will be required on the part of the committee to make these competitive tests. In the first place it will doubtless be impossible to test all the draft gears presented, and it is not going to be an easy matter to draw the line between what will and what will not be accepted. Several promising riggings have very recently been brought out and it may be found desirable to include them. On the other hand, admitting riggings which have not been actually tried in service will open the way for the freak inventors. It would seem well for the committee to decide in the beginning what shall be the requirements for admission to these tests. Further, whatever the scheme of the tests may be, those entering draft gears might well be required to formally approve or disapprove of the methods and apparatus before the work begins. It is not possible for every one to make the best showing, and in the end there is sure to be a certain amount of dissatisfaction among those whose riggings show up badly. It may be just as well to anticipate complaints of this kind.

As to the tests themselves, no one seems to have very well defined ideas as to the information wanted or the methods to be used in testing draft gear and the following is offered merely as a general suggestion and to start discussion:

(1) We will assume that the first tests will show the relative strength of the various gears now on the market. These will necessarily be competitive tests and they should be of such a nature that the conditions will be exactly the same for all riggings. They must therefore be made under laboratory conditions. As we see it, competitive road tests are out of the question. It is thought that drop tests, in which the coupler, springs, yoke and attachments combined are tested to destruction, furnish a ready and fair means for determining the relative strength of different draft gears to resist shocks. Further, that "buffing" tests under the drop are preferable to "jerk" tests as they are easier to make and the severest shocks in service are really the bluffing blows received in switching. If it were found advisable, of course, both "buffing" and "jerk" drop tests might be made. We believe there is some difference of opinion on this point. To insure duplication of conditions in future work these experiments could best be made on a standard M. C. B. drop testing machine.

Supplementing the drop tests, each make of gear, combining the coupler, springs, yoke and attachments should be tested to destruction in a tensile testing machine. These tests where the whole combination of draft gear and coupler is tested show the relative strength of the coupler and minor parts as well as the strength and capacity of the draft gear proper. The results of these tests and the experienced judgment of the committee might then be made the basis for specifications. To insure a fair trial for all it might be advisable to make a series of drop and tensile tests with the various gears and then repeat the work say three or four months later, thus giving the draft gear men, between times, an opportunity to correct any minor defects which develop in the first experiments

(2) There would then remain some important questions which could possibly be best studied without reference to particular makes of spring draft gear; in other words comparative tests between spring gears and friction gears. One point on which there are no data is the practical limit of capacity of spring gears, and it would seem that, in addition to laboratory tests, all-spring gears of say 100,000 to 120,000 lbs. capacity could well be tested on the road against friction gears. The object would be to determine the effect of the recoil on train breakages and to bring out the advantages and disadvantages of high-capacity spring gears and high-capacity friction gears. One company is now working on a dynamometer car designed for just such road tests of draft gear and doubtless many interesting and valuable facts will be brought out when this apparatus is completed. Points which such tests might be expected to settle would be the practical limit of capacity of all-spring gears; how much yielding resistance should be provided in draft gear and whether this can better be got by springs alone or by a combination of spring and frictional resistance. It would seem advisable to have these road tests as free from commercial interests as possible, but of course these interests cannot be wholly eliminated. The idea is that the committee should have a pretty free rein in studying friction and spring gears as types.

Those who are familiar with investigations of this kind will see what a great amount of work is ahead of the draft gear committee even under a simple scheme of tests. It is presumed that suggestions from those interested in the subject will be acceptable to the committee and our columns are open to any one wishing to present his ideas on draft gear tests.

The reader will have observed that the report of the Interstate Commerce Commission, for the year ending June 30, 1900, shows that one passenger was killed for every 64,413,684 miles traveled by passengers. This should be a sufficiently comforting figure for the most exacting reader, for who expects to travel a tenth of that number of miles in a lifetime? In fact the "average man" would have to travel for several lifetimes in order even to get injured, to say nothing of being killed. The real ratio, however, is about three times more favorable to the timid passenger than even that indicated by these large figures, for the Commission bases its average on the total number of passengers killed *by all causes*, 249. The number killed by collisions and derailments, which includes practically all of the casualties which were due to causes beyond the passenger's control, was only 88; and if we divide 16,039,007,317 (the passenger miles) by this number we find that it goes no less than 182,261,445 times. This last number represents the real probability as to the number of miles you will have to travel in passenger cars before you can expect the railroad to kill you. If you confine your journeys to the oldest, best and most traveled lines of railroad you can multiply this number again several times; until, indeed, such a large product (in figures) is reached that the life insurance companies will be willing to insure you for little or nothing. The total number of passengers killed (249) includes, of course, all the fatal casualties, on railroad premises, to all persons who are classed as passengers; such as those caused by falling in getting on or off, accidents in stations, etc. We judge that the number given as killed in train accidents includes only those passengers who were riding in passenger trains and who were killed outright or died within a short time; for the number of passengers recorded in the *Railroad Gazette* as being killed during the 12 months under review was 103. This however, included a few persons who may have been classed at first as fatally injured, and it includes eight who were riding in cabooses or freight cars, some of them riding on these trains for the purpose of caring for animals. In this connection it is of interest to note that in the records to be kept henceforth by the Interstate Commerce Commission passengers riding on freight trains are to be classed separately. The total number of passengers injured in train accidents during the year under consideration was 1,743. This is more than twice the number reported in the *Railroad Gazette*. This discrepancy may be accounted for by the well known facts (1) that the *Railroad Gazette* records, being taken partly from the newspapers, do not include all accidents, and (2) that the railroad companies have to include in their totals many injuries which are too slight to be noticed by the newspaper reporters. The last annual report of accidents on the railroads of Great Britain shows a degree of safety far beyond the figures here given. It is impossible to make anything like an exact comparison between the records of the two countries, as the British report tells us nothing about the number of miles traveled by the passenger; but the number of passengers killed, in the calendar year, was one in 79 millions carried; and this ratio ought really to be halved because the season-ticket passengers are not included. These passengers, counting two journeys a day for each passenger,

must aggregate something like the total of all other passengers, so that the actual average number killed would be in the region of one in 158 millions.

We mentioned, last week, the new members of the directorate of the Northern Pacific Railway. The change is interesting in itself and novel in the way in which it has come about. Mr. J. P. Morgan addresses to Messrs. J. P. Morgan & Co., Kuhn, Loeb & Co., J. J. Hill and E. H. Harriman a letter, in which he says:

"In accordance with the memorandum signed by you under date of May 31, 1901, under which the composition of the board of directors of the Northern Pacific Railway Company to be elected at the next annual meeting was left in my hands. . . . I nominate the following gentlemen: . . . Mr. James J. Hill, President of the Great Northern; Mr. E. H. Harriman, Chairman of the Executive Committee of the Union Pacific Co.; Mr. William Rockefeller, Director of the Chicago, Milwaukee & St. Paul; Mr. H. McK. Twombly, Director of the Chicago & North Western; Mr. Samuel Rea, Vice-President of the Pennsylvania. I would suggest that the attention of the Board be called to the advisability of arranging for these gentlemen to assume their duties as directors of the company as soon as possible without awaiting the annual election. It is my opinion that a board thus constituted will contain within itself the elements best adapted for the formulation of the plan referred to in said memorandum in connection with Mr. Wm. K. Vanderbilt named therein as referee. Every important interest will have its representative. . . ." It is remarkable to have a transaction of such importance carried on in the daylight, and it is also remarkable as an example of the popular theory of "community of interest." It will be observed that the control of all of the great railroads of the Northwest is represented in the new board, the Burlington itself being controlled through the Northern Pacific and the Great Northern. The question of the actual ownership of the majority of the stock of the Northern Pacific is not settled by the composition of the directorate, although that control is believed to rest with the Union Pacific. The gentlemen named are of the highest standing, and the whole arrangement carries on its face assurance of tranquility and unity of interest.

The Appellate Division of the Supreme Court of New York has sustained the decision of the court below that the anti-ticket-scalping law of the State is unconstitutional; and it looks as though the railroads, which are interested in killing off the scalpers, would be obliged to take measures to get a case before the Supreme Court of the United States. The present decision is on a suit against Fleischmann, of Buffalo. Four judges concurred in the decision, Justice P. C. Williams dissenting. The decision is brief, simply holding that the decision of the Court of Appeals on the constitutionality of the anti-scalping law of 1897, in the Tyroler case, is decisive in the case now under consideration. The court says: "We have not deemed it necessary or useful to enter upon a discussion of the merits of the controversy which has arisen because of the enactment of the statutes referred to or on account of similar legislation by the Legislatures of other States. . . . Whatever may be the nature of the arrangement which is evidenced by the ticket, whether it be a token or prima facie evidence of a contract, when the ticket is sold it belongs to the person who buys it, and unless its use is in some way limited it has the same quality as every other kind of property."

NEW PUBLICATIONS.

Proceedings of the American Railway Engineering and Maintenance of Way Association.—This is the report of the second annual meeting held at the Auditorium Hotel, Chicago, March 12 to 14 inclusive. The book contains more than 500 pages, including the reports and discussions on the following subjects: Ballasting; buildings; bridges and trestles; grade crossings; graduation; masonry; organization; rails; records, reports and accounts; signaling and interlocking; ties; track; water service and yards and terminals. Extra copies can be obtained from the Secretary, 1562 Monadnock Building, Chicago. The prices per copy are: Paper binding, $2; Cloth binding, $2.50; and half-morocco binding, $3.

Handbook of Railroad Securities, July, 1901. Compiled by the Commercial and Financial Chronicle. New York: William B. Dana Co., Pine street, corner of Pearl.

The publishers of the *Financial Chronicle* have made a compact and convenient compilation covering railroad and industrial securities. The tables describe in a brief way the various securities, that is to say, the amount outstanding, the rate per year, dividend periods, miles of road operated, gross receipts and net earnings. There are also remarks giving special information that could not be conveniently tabulated. Other tables show the range of prices in New York, Boston and Philadelphia. These tables give the monthly range for 1900 and to July, 1901, also the yearly range since 1895 and the highest and lowest prices for the first half of 1901. Another table shows dividends paid from 1895 to July 1, 1901.

TRADE CATALOGUES.

Pearson Specialties.—The Pearson Jack Company, 64 Federal street, Boston, send a little pamphlet designed to make known the peculiarities and merits of the Pearson car replacing jack, the kingbolt clamp, the ratchet pulling jack, the ratchet journal jack, the Goodwin brake-beam clamp and the U. S. car pusher. All of these specialties are meritorious and are already pretty well known to our readers. Those who do not know about them should send for the pamphlet.

The Burlington's Number One is the title of a pamphlet which has just been issued by Mr. Eustis describing the well-known Chicago-Denver express train of the road named. To the readers of the *Railroad Gazette* the value of the pamphlet is chiefly as a work of art, as the excellences of the train are already well-known. Perhaps we may say that the same knowledge is possessed by most of the people who travel between Chicago and Denver. One decided merit of the pamphlet is the brevity of the text. The description of the luxurious appointments of the train is sufficiently full, while at the same time it leaves the pictures the main feature. These consist of a half dozen full-page wash drawings 4½ in. x 5½ in., by T. K. Hanna, Jr., showing the interiors of the cars, and the people who occupy them. The men in the smoking car are all strong and brave, and wise, and the women in the dining car are intelligent and refined, everyone of them; and yet there is no exaggeration. The picture of the women in the toilet room must be true to life, we are sure, because it represents two of them engaged in leisurely gossip, with the evident purpose of killing time and keeping the other women out. Both the women's toilet room and the men's washroom are so large that they really ought to have sofas or folding beds or something of that sort to fill up the waste spaces; but this feature of the picture is, of course, the result of a kind of poet's license which artists in this line always indulge in. The men in the washroom are courteous and quiet, the big and overbearing fellow whom we meet between New York and Washington or Chicago and St. Louis being conspicuous by his absence. Possibly this also is due to poet's (or passenger agent's) license. The front cover is a striking design in colors. The booklet is worth preserving as a typical picture of ideal life on a "crack train" in the Western States in 1901. Mr. Hanna's work is equal to his best. His ideals are wholesome, while yet he does not soar so high that the reader forgets that it is actual life that he is being entertained with.

Engineering Education.*

BY W. G. RAYMOND.†

With one or two notable exceptions all of the responses to the request for suggestions indicated a considerable degree of satisfaction with things as they are, each instructor simply sending the requirements of his own school as embodying his idea of what should be done. Satisfaction evidences the advisability of a forward step. . . . One or two responses indicated a belief that none of our schools are doing all that they should or can, and that the errors are rather fundamental than matters of detail. As this idea has been growing in my own mind for some years, this paper will contain suggestions that are not simply the result of the thought of the moment, but rather of convictions—open surely to modification—but nevertheless fairly well settled convictions.

This society stands for the betterment of engineering education. There are always two ways of attacking a betterment problem, one involving a study of large questions of general policy, looking to improvements of magnitude; the other, the study of details, not lacking in importance, but each item vastly less important than the matter of general policy.

Good teaching results from the individuality of the teacher. . . . In the main the details of teaching any subject may be left with reasonable safety to the teacher. Such an organization as this has insufficient cause for existence, if, as would seem from the letters received, there is nothing but detail to consider. If, in the main, our engineering courses are what they should be, there is no reason for the considerable expenditure of money, time and mental energy that this association involves. . . . I propose to suggest what seem to me two fundamental mistakes in our school work, and the remedies for them, with the hope that the suggestions may provoke discussion and develop ideas that will result in material improvement commensurate with the effort the society is making.

Wasted time is the great fault of our present methods. It results from:

1—Too much vacation; the school year should be lengthened and the number of years lessened.

2—Class work instead of work with the individual.

3—The mixing of engineering subjects with preparatory and general culture subjects.

Another fault is specialization in what is usually an undergraduate course. The course for the baccalaureate degree should be general, involving the fundamentals of all branches of engineering; the professional or masters degree should follow advanced work in a particular department, either in school or practice, as may seem advisable.

I shall speak very briefly to each of these points.

1—I am not familiar with the all-year plan of work adopted by the University of Chicago, but believe it to be in the direction of what is here proposed. A lady, daughter of an eminent lawyer, and widow of a well-known college teacher, said to me recently: "I suppose you will consider what I am about to say rank heresy, but I think college professors have too much vacation." I was glad to be able to say that I was preparing to take the same ground before this society; though it is the student I am thinking of more than the instructors.

Depending on the extent to which Saturdays are used, on the number of holidays during the school year, and on the nominal length of that year, the actual working school year is from 30 to 33 weeks, with an occasional school requiring even less than 30 weeks and perhaps a few securing more than 33 weeks. Think of it, in any ordinary four years' course the play time is from 13 to 15 months or more; or, allowing for the ordinary business man's vacation, the student loses an entire year of work at a period when it is very important for him to utilize his whole time. It is true that some students use a portion of this time, but would it not be better for them all to be able to use it as a part of their permanent business life?

If eight hours a day be given to work, the course in general engineering that is mentioned hereafter can be accomplished by the average boy in two years time, allowing a vacation of one month each year, all legal holidays and a half holiday on Saturdays. The course represents about as much work as is done in engineering subjects in the good schools with which I am familiar . . . In the course suggested, except in laboratory subjects, one hour stands for three, the usual two hours preparation and one hour class room work.

It is proposed, however, to make better use of the students' time than now, for it is believed that, where classes are large, not less than one-half the time spent in the class room is wasted. Doubtless you will say it is impracticable to make the changes suggested, but I have thought it out to a considerable degree of detail, and believe I can see how it can be accomplished.

2—Individualism: It has long been recognized that continuous personal direction of the pupil by the teacher in such a way as to develop the best the pupil has is the ideal method of teaching. Class work has its value and general directions and explanations, as well as points not covered by text books, may be imparted by lectures and class room talks, but these should be the exception. Certain exercises require several persons for their performance, as surveys, engine tests and the like, but in the main the work should be with the individual rather than the class. This can be accomplished with a student old enough to begin engineering work. The method of doing it will vary with the ideas of the teacher or faculty directing the policy of the school.

The following is submitted as a very general scheme, not worked out in detail. There shall be provided one or two or more general lecture rooms, to be used by all instructors for class work, and for each teacher a large work room with a comfortable office adjoining. The equipment of the rooms will depend on the subjects to be taught. Each student shall pursue a single subject, or at the most two subjects, at one time and until completed. During this period of work in one subject he will occupy a desk, with book rack and drawing table (when necessary) attached, in the work room assigned the teacher under whom he works. Here the student will study, conferring with his teacher when necessary, for, say, eight hours daily, until the subject in hand is mastered. He then goes to another teacher in another room. . . . The details have been somewhat more fully worked out in my own mind, but so long as the details are possible of arrangement, they are not worth discussing until the merits of the general plan have been determined. The idea is so to plan and conduct the teaching work as to secure close personal direction for each individual student and as rapid advancement as his abilities permit.

3—Segregation of Engineering Studies: To secure the greatest economy of time the engineering course should be separated from the other subjects in the school. As it now is, some engineering subjects, as surveying, technical drawing, etc., begin in the so-called freshmen year, while descriptive astronomy, political economy, etc., etc., are frequently left to the junior or senior year. In order to accommodate students coming from various schools, and the student of advanced age, limited means, but good head, who must prepare himself; in order to make the course attractive and economical as to time to college graduates, a class of students we should all like to see increase, and in order to carry out the plan already mentioned, it is desirable to separate the engineering studies from the other undergraduate courses, and to make the engineering course complete in itself.

We hope the time may come when we can require a baccalaureate degree for entrance to an engineering school. . . . Until the baccalaureate degree can be generally required for entrance to the engineering school, each school must determine for itself what shall be its entrance requirements, but to carry out the plan of this paper the preparation in mathematics must include the calculus.

4—Generalization of the Engineering Course: The stock of engineering knowledge has become so great that few men master it all, and it is more than can be expected that a student will master the details of all branches of the profession while in school. At the same time, the various branches are so elevated in all great engineering operations that every civil engineer should know something of the principles of mechanical engineering, elec-

*Extracts from a paper presented at the Buffalo meeting of the Society for the Promotion of Engineering Education.

†Professor of Geodesy, Road Engineering and Topographical Drawing at the Rensselaer Polytechnic Institute.

trical engineering, mining engineering, etc., and vice versa. Therefore, it would seem to be wise to teach in the school the fundamental principles and general practice of all branches, making the accomplishment of a complete course of this character the requisite for a baccalaureate degree in engineering. Subsequent work of note in one or more branches either in practice or school may be rewarded with a professional or master's degree.

I feel incompetent to suggest advanced courses in the several branches of engineering work, but will submit the following outline of a general undergraduate course in engineering for discussion rather than as representing my own final judgment. This much of the paper covers the topic assigned me. Physics, 150 hours; chemistry, 50 hours; engineering materials, geology, mineralogy, metallurgy of iron and steel, 50 hours; mechanics, 150 hours or less; theory and general design of prime movers and transmitting engines, 150 hours; theory and general practice of static structures, 100 hours; theory and general practice of road and railroad location and construciton, 50 hours; theory and general practice of sanitary engineering, 50 hours; theory of surveying, 50 hours; drawing, 300 hours; surveying field work, 300 hours; physical and mechanical laboratory, 300 hours. . . . It is intended to include so much of mechanics as is now given in any undergraduate course, and the hours allotted to this and the other subjects will indicate the writer's first thought as to their relative importance.

The suggestions of this paper are radical, and will perhaps be looked upon as impracticable and impossible of accomplishment. . . . It will doubtless be admitted that a new school can be organized on the basis here suggested, and I believe that such a school would very soon be able to accommodate the applicants for admission.

Railway Transportation Association.

The summer meeting of this Association was held at Niagara Falls, July 17th, with a good representation present.

The Committee on General Transportation Topics recommended that when carload freight is transferred at an interchange point each road bear half the expense; but the arguments, one way and the other, brought out so many knotty points that the report was returned to the Committee for further consideration and recommendation.

The Committee on Car Service, having in hand the subject of "Limiting Class and Size of Freight Cars," called attention to one phase of the large car problem which has apparently escaped particular consideration, i. e., the desirability of basing switching charges upon some unit other than that of a car. Their report on this subject presented the arguments, for and against, but the meeting was not prepared to act, and the committee was requested to prepare a recommendation and present it at the winter meeting.

The report of the Committee on Interchange and Distribution of Equipment deals first with switched cars. As the Car Service Committee of the American Railway Association has this subject in hand, there is a likelihood that the status of the switched car will be definitely determined in the near future. It is a peculiar fact that while M. C. B. rules recognize a certain responsibility for cars by the possessor road, so far as the operating department is concerned there has never been a definite agreement as to the responsibility for a switched car, either as to car or contents. On the recommendation of this Committee the Accounting Officers' Association will be asked to appoint a committee to confer on a standard card way-bill.

This committee recommended the adoption of a form of telegram to be used in ordering cars, the style of which is shown in the following:

Please deliver us at.....	"St. Louis."
carded to.....	"Appleton, Wis., C. & N. W."
for loading	"Furniture."
destination of load.....	"Nashville."
routing, via.....	"St. Louis and your line."
number of cars.....	"Three."
class of cars.....	"50-ft. furniture."
to be loaded not later than...	"July 25th."
order number.....	"21."

Cipher words would be used for the phrases in the first column, when sent by commercial telegraph, and cipher letters when sent by railroad telegraph.

The meeting adopted the recommendation of the committee in this matter, but with an amendment providing for consultation with the Association of Railroad Telegraph Superintendents about the cipher words.

The Committee on Tonnage reported a number of recommendations which were unanimously adopted without discussion. Following is an abstract of these recommendations:

We recommend establishing a tonnage rating for engines, by tests on individual grades, and by use of trains of loaded cars, and also trains of empty cars.

The rolling resistance, when determined, should be shown in the form of an allowance per car rather than by charts.

To increase the tonnage moved per trip a check on the performance and exhibit of the failures are necessary.

Ratings having been established, no trains should be made up or run with tonnage below the rating except on instructions from the Chief Despatcher, Train Master or other division transportation officer.

It should be the Chief Despatcher's duty to obtain a report by wire of the tonnage of each train at each governing point, and to ascertain and exhibit in detail how much engine efficiency was lost and the reasons therefor, such as fast freight, mechanical defects, weather conditions, nothing to move, etc.

The decreased cost to be derived by economical loading must be secured by most careful, immediate and constant scrutiny of the tonnage moved, of the fuel and wages cost per trip and per day and of the time used by trains between terminals. These figures should be shown by the Chief Despatcher or other proper division transportation officer. Any variation of any material amount should be analyzed and explained by him. To provide for uniformity of statistics a brief form is given by the committee, under which it is recommended that all roads should give information concerning engine miles, revenue and non revenue, divided into freight, passenger and switching, the freight to be subdivided into the following four classes: (1) mixed and local; (2) other revenue freight trains; (3) double heading and assistant; (4) light. Switching miles to be divided into yard switching and road switching. Reports on this subject should also contain the following: Revenue tons per freight train mile; revenue tons per freight engine mile; total tons per freight train mile; total tons per freight engine mile; revenue tons per loaded car; revenue tons per car.

The report of the Committee on Loading Freight Cars to Their Full Capacity says that the railroads, as a whole, are not securing more than 60 per cent. car lading as related to capacity. After the expenditure of large sums of money in building cars of heavy capacity the anticipated results are not thus far being obtained. The committee recommends that forwarding agents make daily or weekly reports showing with respect to all loaded cars forwarded from their station, car number and initial, capacity of car (either weight capacity or cubic feet capacity, or both, as may be desired), weight of load, kind of lading, and if loaded less than capacity, stating reason therefor. This agent's report should be made in triplicate, one copy to be sent to the Division Superintendent, one to the General Freight Agent, and one to the head of the Transportation Department. It is necessary to keep the Traffic Department informed in order to secure their assistance in applying a remedy for light loading. On roads which are giving this matter close attention the tonnage per car is increasing. The committee urges upon the Traffic Department the importance of bringing about further increase in minimums on heavy coarse freight.

This report was thoroughly discussed and the subject was referred back to the Committee for definite recommendation at the next meeting.

The president for the ensuing year is E. W. Farnham (Burlington); Vice-President, M. J. C. Wrenne (N., C. & St. L.); Secretary, G. P. Conard, No. 24 Park Place, New York.

The next meeting of the Association will be at Chicago, in January, 1902.

Notes on the Pan-American Fair.

People go to a fair like that at Buffalo first to see the things in which they are directly interested, and after that they look at the rest of the show in a more or less perfunctory way. Hence individual opinion varies, and is largely based on the number and quality of the particular exhibits one is interested in. Going to and from the Saratoga conventions many railroad men spent a day or two at the Pan-American, and the opinion of several of these people accords quite closely with that of the writer, which is from the point of view of the railroad mechanical engineer.

The railroad exhibits proper are in a building at one end of the Terminal Station. The principal locomotive builders are represented by one or more of their latest locomotives, and it would be difficult to collect a finer or more representative lot of engines. Engravings of these locomotives were published with our issue of June 14, and we have illustrated most of them by detail drawings; yet many features of the design and an adequate idea of their immense size can only be got by examining the actual machines. As the locomotives are alongside the New York Central's exhibit of the De Witt Clinton train, this comparison is the more easily made. An excellent opportunity is offered of studying the application of wider fire-boxes to various types of locomotives, and in this respect more may be learned at Buffalo in a couple of hours than in two weeks' travel to see these locomotives on the home roads. One builder shows small electric locomotives.

The car building industry is not nearly as well represented. There are several pressed steel cars of different types, two steel Goodwin dump cars, a refrigerator car, a postal car of the Delaware & Hudson, a Delaware, Lackawanna & Western passenger train equipped with the electric axle-light apparatus and some modern street cars. Besides the cars, the air-brake companies have elaborate exhibits, and the same can be said of car heating and lighting. There are also shown steam shovels, several car couplers, freight car bolsters, chilled and steel tired wheels, flexible pipe joints, rail joints, inspection cars and passenger car curtains and fixtures. Two signal companies exhibit, and an electric brake for street cars is shown applied to full size cars. This is by no means a complete summary of things to be seen, but it is near enough correct to show that the car builders and supply firms are not present in large numbers.

The machine tools are in a separate building as is also the electrical equipment. These displays, especially of the larger companies, are excellent, and many things are shown of interest to railroad men. The most prominent thing of general interest is the electric lighting of the Exposition, which doubtless has never been equaled. A railroad man who does not expect too much can put in a day or two at the Pan-American and be well repaid.

Center Plate Friction.

Extracts from a paper on this subject, by Mr. Willis C. Squire, April meeting of the Western Railway Club, were given on page 282, *Railroad Gazette*, April 26. We now give some of the discussion published in the *Proceedings* of the club for May.

Mr. C. L. Sullivan (Handy Car Co.)—The shape of the contact faces I do not believe is a matter of very great importance. My own preference is for the flat surface, with nearly vertical faces to the ring. I never took very much stock in the idea that the center plate should be of a ball-bearing shape. It is a good center plate, but applying the theory of the ball-bearing to center plates, and expecting corresponding results, I do not believe can be proved in practice. The motion of the largest center plate in the rocking of the car, or in the rocking of the bolster, is very small.

Mr. J. H. Mitchell (Mech. Engr., Pressed Steel Car Co.)—It might not be out of place to say something about the interesting results obtained from a series of tests made last fall on the Pittsburgh & Lake Erie Railroad, under the supervision of Mr. L. H. Turner, Superintendent of Motive Power, to determine the amount of friction in a ball-bearing center plate and side bearing as compared with the flat center plates and bearings now commonly used in freight car service.

The ball-bearing plates and side bearings were made of malleable iron. In the truck center plate were four pockets, the center line of which was a circle possibly 6 or 6½ in. in diam. The pockets were ¼ in. deep at the center and tapered out to nothing at the ends. In each pocket was a 2¼-in. steel ball. The body center plate had a continuous groove ¼ in. deep, the center line being a circle of the same diameter as that on which the pockets were spaced in the truck center plate. The truck side bearing contained a pocket 15 in. long, ¼ in. deep in the center and tapering to nothing at the ends. In each truck side bearing was a 2¼-in. steel ball. The body side bearing contained a groove similar to body center plate.

This arrangement was applied to a 60,000-lb. capacity flat bottom gondola car in June, 1897. In the latter part of October, 1900, after having been in service practically three and one-half years, this car was brought to the shops and trucks were removed.

A very close examination was made of the trucks, and it was impossible to see that any wear had taken place in the flanges of the wheels; even apparently as good as the day the wheels were placed in service. During the three and one-half years of service this car had a mileage of 11,323 miles, and carried 226,440 tons. These results proving satisfactory it was then determined to ascertain, if possible, what decrease in friction was due to this arrangement over that in the ordinary flat plates.

A turn-table, 7 ft. long, was constructed, and one end of this car loaded to its maximum capacity was run on to it. By means of a spring dynamometer it was easy to determine the number of pounds necessary to deflect the truck.

First Test.

	Lbs.	Per Cent.
Plain center plates and side bearings with ⅛ in. deflection of body bolster resting on truck side bearings. Number of pounds necessary to deflect truck	800	100

Second Test.

Plain center plates with outside bearings. Number of pounds necessary to deflect truck.....	275	34

Third Test.

Ball-bearing center plates and side bearings with ⅛ in. deflection of body bolster resting on truck side bearing. Number of pounds necessary to deflect truck	75	9

Fourth Test.

Ball-bearing center plates and without side bearings. Number of pounds necessary to deflect truck	75	9

I understand since these experiments were made a large number of all-steel gondolas of 95,000 lbs. capacity have been equipped with this arrangement.

Mr. F. A. Delano (C., B. & Q. R. R.)—It does not seem to me that Mr. Squire, or Mr. Sullivan either, has made his case, because, after all, this question becomes one of cost. If it costs more to lubricate center plates than the value of doing so, it will not pay to do it, and that question has not been touched. Furthermore, I question very much whether any lubricant or paste could be made to stay in the center plates with the weights per square inch that they carry. It is possible that graphite or something of that kind could be used, but with a good gray iron center plate a certain amount of lubrication should come from the graphite in the iron. Then, again, it appears from Mr. Squire's tests that the friction is very much reduced by machining or grinding the center plates before they are put in, and if that is done, the added advantage from any lubrication amounts to practically nothing. There is one thing that this paper suggests, and that is, if the friction amounts to as much as he shows in the case of center plates, how much more it must amount to in the case of side bearings.

Mr. S. P. Bush (Buckeye Malleable Iron Co.)—The paper is an excellent one, in that it brings the subject up in concrete form; it shows something specific, which

is always a good thing to do, and not always an easy thing to do. It brings up the subject of the curving resistance of cars, and there is no doubt in my mind that the curving resistance is considerable.

The first experience I ever had was this. We were making some tonnage tests on a piece of track with a 1 per cent. grade and a good many curves. We were trying to arrive at a satisfactory tonnage rating for engines. Several years ago we had some fully loaded 60,000-lb. capacity box cars, all loaded with anthracite coal, and after several trials arrived at the tonnage that would be satisfactory.

We hauled up the grade the same tonnage in empty cars that we succeeded in hauling with loaded cars, and we went up easily, and the result was that we were able to pull more tons in the empty cars at a speed of five or six miles an hour than we could in loaded cars, and the difference was enough to make it important. In looking about for the reason of that, I found that every car that was overloaded was bearing heavily on its side bearings. Now center plate resistance is simply a degree of that. Mr. Sanderson says that where the pressure comes on to the side bearings it becomes still worse. But it brings up, as I say, the whole question of curving resistance, and it shows that it is very considerable. I believe thoroughly in the principle of arrangement or construction which is going to relieve both the center plate and the side-bearing resistance.

Foreign Railroad Notes.

The International Sleeping Car Co., at its annual meeting in Brussels recently, reported that its business in 1900, which was a World's Fair year, was expected to be exceptionally profitable, had turned out disastrously and that no dividend could be paid. A number of new limited trains, wholly of cars belonging to the sleeping car company, were put on in this year, but the company also owns a number of palatial hotels in various parts of Europe and Africa, chiefly at fashionable winter resorts. The gross earnings were 19 per cent. greater in 1900 than in 1899.

There is a German "Society of Locomotive Engineers and Firemen," comparable with the well known brotherhoods in this country. This society held its annual convention in Munich June 3 last, in the great room of a brewery, adorned for the occasion, where a representative of the Bavarian cabinet, and the General Manager of the Bavarian State Railroads, made welcoming addresses, while at a great ball given at the close of the convention the Prime Minister was present. An excursion train which took delegates to the convention to one of the beautiful lakes near Munich was hauled by one of the American express locomotives recently received by the State Railroads, and this engine was an object of intense interest.

In Austria one Sunday a passenger came to a station ticket window 11 minutes before train time. There was a crowd, as usual on Sunday, and he did not receive his ticket until very nearly train time. When he reached the platform the train was still standing, but he was not permitted to go to it. He then took a following train which did not stop at his station, got off at the nearest station when he did stop and hired a carriage to take him home. He sued the railroad for his cab hire, and for the difference between the fare he had paid and the fare to the place where he left the train. The court found in his favor and gave judgment for the carriage hire ($1.25), but not for the 12 cents difference in fare, as this, it said, was made good by the carriage transportation. The man who asks for a ticket in time and pays for it, is entitled to what the ticket calls for, and if he is kept from it either by slowness at the ticket office or by a crowd which overfills the train, he is entitled to damages.

TECHNICAL.

Manufacturing and Business.

The American Machinery & Export Co. has moved its office from 15 Cortlandt street to 120 and 122 Liberty street, New York City.

Frederic Arnold Kummer, C. E., until recently Manager of the Eastern Paving Brick Co., of Catskill, N. Y., has been appointed General Manager of the United States Wood Preserving Co. The office of the company has just been moved to the Columbia Building, 29 Broadway, New York City.

Henry W. Toothe, for the past 11 years with the Midvale Steel Co., has accepted a position in the railroad department of the Magnolia Metal Co., with office in New York City. Mr. Toothe needs no introduction to our readers, having been identified with the railroad supply business for the past 20 years.

Iron and Steel.

C. E. Stafford, heretofore with the Illinois Steel Co., is now President of the Tidewater Steel Co., Thurlow, Pa.

Walter Rachels, Chief Engineer at the Ohio works of the National Steel Co., Youngstown, Ohio, has resigned and is succeeded by Willis McKee.

The Mexican Gulf Construction Co., of Chicago, was incorporated in Delaware, July 19, with a capital of $1,250,000, to build railroads, bridges and public works.

H. C. Duggan has resigned as Superintendent of the South Bend Malleable Iron Co., to become General Manager of the American Malleable Casting Co., of Chicago.

The plant of the Elmira (N. Y.) Steel Co. was sold at auction, July 18, to H. H. Ginsberg, representing the Girard Iron & Metal Co., of Philadelphia and Buffalo. The consideration was $106,000.

Alabama furnace men are gradually enlarging their output. The Hattie Ensley furnace of the Sloss-Sheffield Co., which has been idle for several years, has resumed operations, with a daily output of 200 tons. A furnace of the Woodstock Iron Co., at Anniston, which has been idle for some time, has also resumed, as have also the furnaces of the Jenifer Iron Co., at Jenifer, and of the North Alabama Coal & Iron Co., at Talladega.

The Iron Trade Review reports that the largest producer of rails has closed several contracts for standard sections for delivery during the early months of next year at $28 per ton at the mill. Beyond this nothing has been done toward fixing the price for delivery next year and it is probable that with a continuation of the present level of prices the railroads will be given an opportunity next year of closing contracts at $26 per ton, which was the price that prevailed this year until May. Rail mills are all practically sold up until the end of the year and small orders of heavy section rails are being filled from the rails left over after large orders have been filled, chiefly seconds. Demand for light rails continues strong and high prices continue to rule.

Fireproof Receptacle for Fusees.

The Chicago, Milwaukee & St. Paul is equipping all its freight cabooses with a metallic case for holding the fusees, torpedoes and matches carried on freight trains. The case or box is made of galvanized iron and is fastened to the side of the car. It is about 12 in. high, 15 in. long and 4 in. wide. The arrangement is patented by Mr. Herbert E. Smith, Chief Clerk in the General Superintendent's office.

Railroad Material for Ecuador.

It is stated that shipment of the Carnegie rails for the Guayaquil & Quito Railroad, Ecuador, will be made at the rate of 2,000 tons per month. A consignment of Baldwin locomotives, American Car & Foundry cars and American Bridge Co. bridges will also go monthly until the rolling stock referred to in contracts mentioned March, p. 149, has all been forwarded to the South American road. Each shipment will aggregate between 2,500 and 3,000 tons.

New Passenger Locomotives of the Michigan Central.

The Michigan Central has recently received from the Schenectady Locomotive Works ten large locomotives of the "Central-Atlantic" type, which are given excellent results in heavy, fast passenger service. The cylinders are 21 x 26 in.; the total weight is 176,000 lbs. The weight normally on the drivers is 95,000 lbs., which, by means of a traction increaser, can be raised to 107,000 lbs. The driving wheels are 79 in. in diam. and the fire-box is 96 in. long x 75⅜ in. wide. The grate area is 50.3 sq. ft. The boiler is of the extended wagon top type, having 3,505 sq. ft. of heating surface and carrying a working steam pressure of 200 lbs. The tenders have a capacity of 5,000 gals. of water and are fitted with water scoops.

Rules of Interchange.

Secretary J. W. Taylor, of the Master Car Builders' Association, Rookery Building, Chicago, announces that the Rules of Interchange, as revised this year, are now ready for distribution. The prices are the same as heretofore: 25 copies, $1; 50 copies, $1.75; 100 copies, $3. Postage is added when books are sent by mail. Mr. Taylor will also receive requests, to be transmitted to Washington, for copies of the pamphlet, issued by the Interstate Commerce Commission, containing the rules which have been compiled for the guidance of the inspectors of the Commission in their examination of cars for defects which violate the Federal laws concerning safety appliances. The Secretary of the Interstate Commerce Commission has agreed to furnish to the members of the Association, without charge, as many copies as they may want.

The Transportation Jury at the Pan-American.

The following are the members of the Jury of Awards in the Transportation Department of the Pan-American Exposition: H. G. Prout (Chairman), Editor *Railroad Gazette;* Prof. H. C. Peabody, Massachusetts Institute of Technology; Prof. R. C. Carpenter, Cornell University; Major John M. Carson, U. S. A.; Col. D. P. Heap, Corps of Engineers, U. S. A.; Rear Admiral F. T. Bowles, Chief of Bureau of Construction and Repairs, U. S. N.; Rear Admiral M. T. Endicott, Chief of Bureau of Yards and Docks, U. S. N.; A. Swasey, Esq., Cleveland, Ohio; A. V. Abbott, Esq., Chicago, Ill.; J. E. Watkins, Esq., National Museum, Washington, D. C.; Lieut. C. H. McClellan, U. S. N.; W. S. Aughinbaugh, Esq., U. S. Patent Office; Prof. George D. Shepardson, University of Minnesota; H. M. Paul, Esq., Bureau of Yards and Docks, U. S. N.; A. C. Bostwick, Esq., New York.

River and Harbor Works.

Capt. D. D. Gaillard, Corps of Engineers, U. S. A., in charge of river and harbor improvements for the Duluth (Minn.) district, in his annual report recommends the following appropriations in excess of $25,000 for the next fiscal year: Duluth, Minn., $459,727, to complete existing project; Ashland, Wis., $65,000, of which $50,000 is for continuing improvement; Marquette Harbor, Mich., $63,600, of which $60,000 is for improvement; harbor of refuge at Grand Marais, Mich., $105,000.

Among the propositions that will go to Congress for river and harbor work in the New York District, are the following: Bronx River, $30,000, to remove obstructions in 50-ft. channel near Milward Bridge, and for dredging; Flushing Bay, $25,000, to be applied to maintaining and widening dredged channel; East River and Hell Gate, $300,000, besides the unexpended balance July 1, 1901, amounting to $106,969, which is to be used to finish the removal of Mars Rock to a depth of 26 ft. and reefs off Third and Twenty-sixth streets, respectively. The appropriation recommended for the next fiscal year is to be expended in removing wrecks included in the projects, doing first the work most urgently needed; for Harlem River, $500,000 is recommended to be applied to widening and deepening the channel by dredging and in constructing bank revetment, if deemed necessary, in accordance with approved project; to increase width of channel between Staten Island and New Jersey, $30,000.

The American Blower Company's Exhibit at Buffalo.

The exhibit of this company, in block No. 26 of Machinery Hall, at the Pan-American Exposition includes heaters, fans, engines, blowers, dry kilns, trucks and other machinery for similar uses. A model of the "Moist-Air" dry kiln having a glass side which reveals the operation of the kiln, has received much attention from visitors. A 140-in. full-housed steel plate fan, driven by an 8-in. x 8-in. marine type vertical engine, coupled direct to the fan shaft, has been made into a decorative feature by putting in the mouth of the discharge a great number of yellow and blue ribbons (the college colors of the University of Michigan) which stream upward when the fan is running. In the wall back of the exhibit there is a 108-in. disk fan.

There are also shown a Moorehead automatic return steam trap in operation; a large pressure blower mounted on a Z-iron base, on the other end of which is a vertical, automatic high-speed engine for driving the blower; a horizontal automatic high-speed engine, a vertical low-pressure engine, and a number of A, B, C exhaust fans with the well-known adjustable features.

The booth is one of the handsomest in the building, the general scheme being in ivory white and deep green. This feature is about 20 ft. high and has a gable end resting on columns. Above there is a painting nearly 60 ft. high, emblematic of the American blower.

THE SCRAP HEAP.

Traffic Notes.

The New York Central is giving a more liberal time limit on the low price tickets to the Pan-American Exposition from points west of Albany, and will sell these tickets every day instead of only four days a week.

The Northern Pacific will make a special low rate for farm laborers from St. Paul to all stations in Minnesota and North Dakota to aid in getting the grain crops promptly harvested. From July 29 to August 20 parties of five will be taken at $5 each.

It is said that on the passenger trains of the Lake Shore & Michigan Southern between Cleveland and Buffalo detectives are now employed, one for every two cars, to look out for ticket brokers who ride on the train and buy return portions of low-price excursion tickets to the Pan-American Exposition.

Myers & Houseman, dealers in live stock at Baltimore, have entered suit against the Baltimore & Ohio, charging the road with discrimination against them in requiring them to receive their cattle through the Union Stock Yards, in violation of the Interstate Commerce Law. Damages of $25,000 yearly and more, are alleged.

Judge Kohlsaat, in the United States Circuit Court, at Chicago, refused to issue an injunction restraining the railroads from refusing mixed carload freight. The injunction was asked for by various shipping brokers against the Grand Trunk and the Lackawanna roads. These brokers gather small lots of freight from several clients and by shipping them together as car lots obtain a lower rate. This was objected to by the railroads and the objection is now sustained by the court.

Internal Revenue Tax on Express Traffic.

The Commissioner of Internal Revenue holds that the abolition by the act of March, 1901, of the tax on receipts or bills of lading given for goods sent by express, is not applicable to railroad companies, but only to persons, companies or corporations doing express business exclusively. A railroad carrying milk must stamp the receipts given to the shippers.

Stock Runs on the Santa Fe.

The Topeka State Journal, commenting on the heavy and satisfactory stock business of the Santa Fe for the present season, says double-heading of stock trains has been discontinued because with long trains there were more delays. It is said that all demands for cars have been promptly met and that out of 2,895 cars of Texas cattle hauled but one animal died in the cars. It is reasonable to believe that this one case of death might be diagnosed as heart failure (from some cause or other) and, aside from that, this is a remarkably good record for hot weather—or for any weather.

Chinese Railroads.

An edict has just been issued from Pekin which approves the semi-annual interest payment on the English loan on the northern roads, which amounts to $200,000. It was at one time thought that the Hong Kong Bank would be allowed to foreclose the mortgage.

Oiling Roadbed in California.

The Atchison, Topeka & Santa Fe is sprinkling oil on its roadbed near Fresno, Cal. According to a newspaper account 30 miles of road has already been sprinkled. The same account states that the use of oil on highways in California is increasing each year.

Bosnian Railway.

A bill for extending the Bosnian Ry. system, Austria-Hungary, at a cost of about $15,000,000, is being considered by the Hungarian chamber.

Two California Electric Power Plants.

Two electric power plants, one to develop 12,000 h.p., the other 3,000, are planned to be built in Shasta County, Cal., this year. One, the Shasta Electric Light & Power Co., has pre-empted 50,000 in. of water of the McCloud River at a point 14 miles above where that stream joins the Pit. The power obtained will be used to run the

electric railroad connecting the Bully Hill mines with the Southern Pacific. The works are expected to be in operation by November. The cost will approximate $1,000,000.

The Keswick electric light and power plant will also be in working order before the close of the year. This is intended to furnish power for the Keswick smelters. The generating works will be operated by water taken from Battle Creek and the power will be transmitted a distance of 36 miles.

The State as a Rate-Maker.

As the movement for uniform classification seems to be making but little progress this year, its promoters will, perhaps, be glad to learn of an incident in Texas which may be of use to them. We quote from the *Houston Post*:

A late ruling of the railroad commission, fixing the minimum freight rate on open cars of freight at first class rate and the minimum weight at 20,000 lbs., threatens one of the principal industries of Brenham. Two firms in Brenham have galvanized iron cistern factories, and both have built up big trades in this line, and this ruling almost precludes the shipping of their product. One of the gentlemen engaged in the manufacture of cisterns thinks that the business is ruined and that both factories will have to stop making them for shipment, and only supply local orders.

Illinois Central Improvements at New Orleans.

President Stuyvesant Fish, of the Illinois Central R. R., has informed the authorities of New Orleans that his company has abandoned its project of building extensive wharves within the limits of that city, owing to unsatisfactory action of the New Orleans Council on the company's application for privileges. The management will also abandon the project of building in New Orleans a new 1,500,000 bushel elevator, which was contracted for some time ago. This proposed elevator was to have replaced the adjacent Southport elevator, which the high waters threatened to wash away. President Fish says in a letter to the Mayor of New Orleans: "We had hoped to be able to continue to handle all our New Orleans freight within the limits of the city. We, however, realize that if the position taken by the city in respect to the ordinance lately withdrawn is adhered to, we must before long provide facilities at Harahan or elsewhere for handling our export and import traffic, which must be done in a place by itself, and with appliances designed and used solely for such purposes." It is the purpose of the Illinois Central to apply to the Federal Government for authority to build terminal wharves and buildings on its property at Harahan, La.

Electric Railroad Development in New York State.

The State Railroad Commissioners have given out an account of electric railroad lines, building and proposed, from which we take the following paragraphs:

The trolley roads are creeping up the valley of the Hudson River toward Albany, and already there is an electric road from Albany to Hudson. Between Albany and Pittsfield, Mass., there will soon be a trolley line. Albany is already connected with Lake George by trolley, and westward of Albany the trolley lines are creeping in fast between it and Buffalo. The new Albany and Schenectady line is nearly finished. Schenectady and Amsterdam will soon be connected. Fonda and Amsterdam are also to be connected by trolley, and tracks are now being laid between the two places. Utica, with its suburban roads, within a few months, it is said, will have a trolley line extending as far eastward as Little Falls. A line goes northwestward from Utica as far as Oriskany, and will soon reach Rome. An Oneida railroad company intends connecting Rome and Syracuse. Then comes a gap between Syracuse and Rochester, but recently there were filed articles of incorporation of the Monroe County Electric Belt Line, which intends to build an electric line from Rochester to Fairport, 10 miles on the road to Syracuse.

The big gap between Rochester and Buffalo is to be filled at once, the Railroad Commissioners having given consent to the Buffalo, Niagara Falls & Rochester Electric Railway to build a line 120 miles long, along the Ridge road and connecting Rochester, Lockport, Niagara Falls and Buffalo. Beyond Buffalo there are two lines to Hamburg, and it is reported that one of these lines will be extended to Angola and Silver Creek, while the Dunkirk line may be extended toward Buffalo.

Railroad Between Southern India and Ceylon.

The South Indian Railroad is considering extending its line across the Palk Strait to Ceylon, between which there is a chain of islands and reefs known as Adam's Bridge. One of these islands, known as Rameswaram Island, is divided from the mainland by a channel 1¼ miles wide, known as Paumbaum Pass. It is proposed to carry the railroad across this channel so as to connect the island with the main railroad. The preliminary plans provide for building a solid causeway across the channel with the exception of an opening of 130 ft., to be spanned by a swing bridge and a smaller opening 30 ft. wide, over which a fixed bridge will be built.

Canadian Railroad Appropriations.

The following are some of the larger estimates approved by the last session of the Dominion Parliament for the Intercolonial Ry.

Rails and fastenings	$660,000
Completion of bridge at Rocky Lake	3,000
Building and enlarging engine houses	75,000
Increasing accommodation at Sydney	100,000
Increasing accommodation at Halifax	60,000
Additional sidings along line	178,000
Increased accommodation at St. John	100,000
Increased facilities along line	50,000
Extending car shops at Moncton	25,000
M. C. B. couplers for engines	3,000
Air-brakes to freight cars	40,000
Changing couplers of passenger cars	10,000
Equipping passenger cars with vestibules	10,000
Exchanging drawbars of freight cars	15,000
Gas apparatus for 10 cars	8,000
Large turn-tables	5,000
Superstructure for six spans of Miramichi bridge	72,000
Cars and engines	413,000
Three traveling cranes	4,500
Extra conveyor at St. John	17,000
Widening Bennet's cutting, Levis	10,000
Improving ferry service, Canso	70,000
Increased facilities along line	48,400
Strengthening iron bridges (re-vote)	75,000
Increased accommodation at Levis (re-vote)	35,000
Towards building additional engine houses (re-vote, $45,000)	60,000
Towards improvements at Mulgrave (re-vote, $10,000)	13,000
To provide drop pits (re-vote)	5,000
To increase facilities and accommodation along line (re-vote, $48,000)	93,600
To build overhead bridge at Drummondville	6,000
Increased accommodation at Stellarton	20,500
Increased accommodation at Pictou	45,000
Nine electric and four mechanical semaphores	4,000

Trolley Supervision in Connecticut.

A new law has become operative in Connecticut placing the electric street roads under the regular supervision of the Railroad Commissioners. The Commissioners now have entire jurisdiction and direction over methods of construction and materials used, and they are required to inspect every line periodically. The electric roads hitherto have been without any general State supervision, although they carry 65,000,000 passengers annually.

Level Crossings in France.

The famous Paris newspaper, *Figaro*, whose wide reputation has not been made in the field of economics, however, has been making a crusade against level crossings on the French railroads. It says that there are 6,619 such crossings on the Paris, Lyons & Mediterranean Railroad (5,608 miles) and 2,975 on the Northern (2,328 miles), which is an average of 1.21 crossings per mile of railroad, which seems pretty thick.

Chinese Railroads.

The Shantung Railroad, which the Germans are building in China, was opened with an excursion from Tsingtow to Kiauchow April 8, and trains began running between those places three times a week, making the trip in three hours. An extension 16 miles further, to Kaumi, was to be completed in a few weeks. The Germans claim that this is decidedly the best built railroad in China.

L'Automobilism.

Two men in an automobile left Munich for Venice May 25, crossing the Alps by the Brenner Pass, and beating the ordinary passenger train by four hours, but being an hour longer on the road than the express train. The distance is about 300 miles, but the express takes about 17 hours for the trip.

Passengers to the Paris Fairs.

Curious statistics of the passengers from foreign countries to Paris during the World's Fair have been published by the French Northern Railroad, which was the chief carrier of visitors to the fair from the northern countries of Europe. The numbers are given for the exhibition season both in 1900 and in 1889, as follows:

	1900.	1889.
From England	206,338	227,662
Belgium and Holland	419,438	299,740
Germany	102,536	56,618
Russia	28,020	4,683

The effect of propinquity is evident, as always in such cases. Little Holland and Belgium sent twice as many visitors to Paris as Great Britain, and four times as many as Germany—or rather North Germany; for South Germans would go to Paris over the Eastern Railroad rather than the Northern.

Yerkes' London Traction Line.

According to a London despatch of June 19, Charles T. Yerkes has filed articles of incorporation of the Metropolitan District Electric Traction Company, together with the names of the shareholders, at Somerset House, London. Mr. Yerkes appears as chairman. J. Wilcox Brown, President of the Maryland Trust Company, as Secretary, and the following as the American directors: John M. Parsons, of Philadelphia; Brown Bros. & Co. and H. H. Rogers, of New York; Jefferson Coolidge and Frederick Ayers, of Boston, and John H. Mitchell, of Chicago. Of the capital £1,000,000, Mr. Yerkes holds £336,000.

The College Man and the Railroad.

The late Mr. H. B. Stone used to say to the college men who thought of starting in railroading, that if they felt at all dubious or discouraged, he would prefer not to have them take hold. He was convinced that whenever an educated or professional man went into railroad service and made a failure, either by getting discouraged and giving up or in some other way, he increased the difficulties very much for the next man.

Across Asia in Nineteen Days.

According to a report from Consul-General Holloway, dated St. Petersburg, June 22, the Trans-Baikal Railroad is completed, and trains are now running between Moscow and Stretensk, on the Amur River with, of course, the break at the lake. The "train du luxe" leaves Moscow every Wednesday at 8:35 p. m., reaches Irkutsk at 6:30 p. m. on Thursday of the following week, and leaves there the next morning for Lake Baikal. Passengers cross the lake in the steamer *Angara* in nine hours, reaching Mysovaia, on the opposite shore, at 6:30 p. m., and arrive at Stretensk at 10:37 on Monday, 11 days from Moscow. The first-class fare to Stretensk is $58.14. From Stretensk to Khabarovsk, by steamer on the Amur River, requires a week, the fare being $21.79. From Khabarovsk over the Ussuri Railroad to Vladivostock requires 32 hours and costs $8.49. This reduces the time between Moscow and Vladivostock to 19 days. Steamships require six weeks to go from Odessa to Vladivostock, and the passage costs $257.50.

Railroad in Dahomey.

The Consul at Marseilles reports the formation of a corporation to exploit a railroad in Dahomey. The name of the society, which is organized for 75 years, is "La Compagnie Francaise du Chemin de Fer du Dahomey," with headquarters at 5 rue D'Antin, Paris. The capital of the company is $1,544,000.

LOCOMOTIVE BUILDING.

The Prince Edward Island has ordered two engines from the Canadian Locomotive & Engine Works.

The Chicago Union Transfer Co. has ordered four consolidation engines from the American Locomotive Co.

The Atchison, Topeka & Santa Fe is referred to in newspaper reports as having ordered 40 locomotives from the American Locomotive Co. Last May the road ordered 40 simple locomotives from the International Power Co. (before its absorption by the American Locomotive Co.) but the order has since been changed to consolidation engines of the four-cylinder tandem (Schenectady) compound type. They will have wide fireboxes, weigh about 200,000 lbs. and have cylinders in size equivalent to a 21-in. x 32-in. simple engine.

The Oregon Short Line has ordered from the Lima Locomotive & Machine Co., one 65-ton Shay locomotive. This engine is to be used on a mountain branch which has 5½ per cent. grades. It will weigh (empty) about 113,000 lbs.; will have three cylinders, 13 in. x 13 in.; 12 drivers 32 in. in diam.; 48-in. boiler; Shelby steel tubes; tank capacity for water 3,000 gals., and coal capacity five tons. Engine will be equipped with Buckeye couplers, Sullivan metallic packing on piston rods and valve stems, Leach sanders, Nathan injectors and Star steam gage.

The El Paso & North Eastern has ordered one 100-ton Shay locomotive from the Lima Locomotive & Machine Co. This engine is designed to work on a branch of the road having 4 per cent. and 5 per cent. grades. The engine will weigh (empty) 183,500 lbs., have three cylinders 15 in. x 17 in.; 16 drivers 40 in. in diam.; 60-in. boiler; Shelby steel tubes; tank capacity for water, 6,000 gals., and coal capacity, nine tons; will be equipped with Westinghouse brakes, Tower couplers, U. S. Metallic packing on piston rods and valve stems, Leach sanders, Friedman injectors, Michigan lubricators and Star steam gage.

The Canadian Pacific has placed an order with the Lima Locomotive & Machine Co. for one 91-ton Shay locomotive for use on one of its mountain divisions, on which there are 4.2 per cent. grades. It will weigh (empty) about 162,000 lbs., will have three cylinders 15 in. x 17 in.; 12 drivers 40 in. in diam.; boiler, 56 in. in diam.; Shelby steel tubes; tank capacity for water 3,500 gals., and coal capacity of six tons. Will be equipped with Westinghouse brakes, Washburn couplers, U. S. metallic packing for piston rods and valve stems, Leach sanders, Monitor injectors, Michigan lubricators and Star steam gage.

CAR BUILDING.

The Canada Northern is asking bids on 500 box cars of 60,000 lbs. capacity.

The Chicago & Alton has ordered one cafe smoking car from the Pullman Co.

The St. Lawrence & Adirondack has ordered one coach from the Pullman Co.

The Mobile & Ohio has ordered 1,500 cars from the American Car & Foundry Co.

The Cane Belt has ordered 120 flat cars from the American Car & Foundry Co.

The Manhattan Elevated has ordered 400 motor trucks from the American Car & Foundry Co.

The Hastings Express Co., Chicago, has ordered three 45-ft. express cars from the Pullman Co.

The Canada Southern has ordered 500 freight cars from the Illinois Car & Equipment Co.

The Erie has ordered 1,000 steel cars of 100,000 lbs. capacity from the Pressed Steel Car Co.

The Cleveland, Cincinnati, Chicago & St. Louis is having 30 freight cars built by the Pullman Co.

The American Car & Foundry Co. has received orders from individual companies aggregating 92 cars.

The Canada Northern has ordered 100 box cars of 60,000 lbs. capacity from the Crossin Car Mfg. Co.

The Macon, Dublin & Savannah has ordered five passenger coaches from the American Car & Foundry Co.

The Lake Erie & Western is having 25 cars built at the Chicago works of the American Car & Foundry Co.

The American Refrigerator Transit Co. has ordered 100 refrigerator cars from the American Car & Foundry Co.

The Chicago Great Western is in the market for four chair and four combination cars, and it is reported that the road will order about 60 coaches the first of the year.

The Mobile & Ohio has ordered from the American Car & Foundry Co. the following equipment: Seven hundred box, 200 ventilated box, 550 gondola and 50 furniture cars.

The Texas Central has ordered 20 flat cars of 60,000 lbs. capacity from the American Car & Foundry Co. The specifications include Westinghouse brakes and Chicago couplers. The road has also ordered two first class passenger coaches and one combination mail and express car, for December delivery, from the Pullman Co.

The Pennsylvania has ordered 2,000 box cars of 100,000 lbs. capacity, 750 from the American Car & Foundry Co., and 1,250 from the Pressed Steel Car Co. They will be of wood with steel underframes and follow the dimensions recommended by the committee of the American Railway Association, namely, 36 ft. long, inside, and 8 ft. 6 in. wide; but the height inside from floor to car line will be 8 ft. instead of 7 ft. 6 in., the 6 in. being gained by the use of pressed steel sills without increasing the outside height of the car at the eaves.

BRIDGE BUILDING.

Albany, N. Y.—In our issue of July 12 (p. 506), we gave a list of bridges for which plans are being made for the State Superintendent of Public Works. The following are additional bridges for which plans are now being made, and as soon as the plans are approved by the State Engineer and the Canal Board, the work will be advertised by John N. Partridge, Superintendent of Public Works: Steel bridge over Glens Falls Feeder in the town of Queensbury, to be about 70-ft. span, with 16-ft. roadway and 5-ft. sidewalk, appropriation, $6,000; bridge over Cattaraugus Creek on the Cattaraugus Indian Reservation, near the village of Versailles, to consist of three spans, each about 120 ft., the bridge to be about 18 or 20 ft. wide, appropriation, $17,000; steel bridge over Champlain Canal at Fulton street, Waterford, to be a plate girder of 56 ft., with one roadway 18 ft. wide and one 5-ft. sidewalk, appropriation, $10,000. The dimensions are approximate as the plans are not finished. Edward A. Bond, State Engineer.

Atlanta, Ga.—The Council has granted a franchise to the Atlanta Rapid Transit Co. for a street railroad line on Peters street, provided a contract is signed for a public viaduct over the Peters street crossing. (May 17, p. 340.)

Au Sable, Mich.—The Detroit & Mackinac, we are told, is considering building a steel bridge over Au Sable River, replacing the old trestle. The company has recently let a contract to the Detroit Bridge Co. for a 228-ft. single-track trestle over Hale Creek.

Bridgeport, Conn.—The New York, New Haven & Hartford is said to have let all the contracts for elevating the tracks through Bridgeport, except the contracts for the Scherzer rolling lift bridge (May 3, p. 305), and the new passenger station.

Buffalo, N. Y.—The Department of Public Works will receive bids, until Aug. 1, for a bridge on Stevenson street, over Cazenovia Creek, according to plans and specifications on file in the office of the Bureau of Engineering. R. G. Parsons, Secretary.

Charleston, W. Va.—The Chesapeake & Ohio, ac-

cording to report, will build a bridge over Kanawha River.

CHICAGO, ILL.—The American Bridge Co. has the contract for the superstructure of the Randolph street bridge at $107,000.

CLEVELAND, OHIO.—The Findlay & Southern Ry. is having plans made for seven deck bridges, three at Unionville and Plain City, one at Marysville, one at Kenton and one each over Blanchard River and Wolff Creek. R. Rosenstock, Cleveland, Chief Engineer.

Regarding the report in our columns, July 12 (p. 506), that the Osborn Engineering Co. was making plans for a bridge for the Euclid & Wickliffe Plank Road Co., we are told that they are not making plans for such a bridge. They made plans some time ago for a bridge on the extension of Euclid avenue for the Commissioners of Cuyahoga County. This bridge is to be a stone arch or a concrete arch. The contracts have not been awarded.

ELLSWORTH, ME.—We are told that the City Government is considering building a bridge over Union River. George B. Stuart, chairman of the committee.

IOLA, KAN.—Bids are wanted, Aug. 6, for a steel or concrete bridge over Marmaton River. C. A. Fronk, County Clerk.

MACON, MO.—We are told that bids are wanted, Sept. 2, by F. M. McGee, County Surveyor, for seven steel bridges, of an average length of 40 ft.

MARIETTA, OHIO.—The Secretary of War has issued a permit to the Williamstown & Marietta Bridge & Transportation Co., to build its proposed bridge over the Ohio River between Marietta and Williamstown. The new bridge will have one river pier, with piers on each bank, with two 800-ft. spans. D. M. Marshall is President. The plans were made by Herman Laub, of Pittsburgh, Pa.

MCKEESPORT, PA.—Bids are wanted, Aug. 1, by E. K. Morse, 904 Carnegie Bldg., Pittsburgh, for the cantilever bridge over Monongahela River at Glassport as mentioned July 12, p. 506.

MCKITTRICK, MO.—The County Court of Montgomery County, we are told, is considering building a steel bridge of about 140-ft. span, high truss. T. L. Cardwell, County Surveyor, New Florence, Mo.

MT. JACKSON, VA.—The County Court of Shenandoah has appropriated $5,000 for a steel highway bridge over Shenandoah River, subject to the approval of the Board of Supervisors.

MT. PLEASANT, TENN.—Plans are finished, according to report, and bids will be wanted in about two weeks for a pony truss steel bridge at this place.

NEVADA CITY, CAL.—The Board of Supervisors has ordered the County Surveyor to make plans and specifications for a bridge over Kentucky ravine; also for repairing the bridge over South Yuba River at Cole's.

NIAGARA, WIS.—The Marietta County Supervisors are reported to have decided to build the proposed bridge over Menominee River between Niagara, Wis., and Quinnesec, Mich., at a cost of about $12,000. The Legislature of both states have authorized this bridge. (May 10, p. 321.)

ONEONTA, N. Y.—It is estimated that the cost of a viaduct over the Delaware & Hudson tracks at the main crossing will be $80,500.

ONEIDA CASTLE, N. Y.—The Railroad Commission gave a hearing last week on the petition for a crossing over the Ontario & Western tracks. The State Grade-Crossing Engineer estimates the cost of a viaduct at $92,000.

PERRY, N. Y.—We are told that the town meeting, at which the proposition to build a bridge over Silver Lake was passed, was illegal. The proposition will have to be resubmitted.

PITTSBURGH, PA.—The contract for the masonry for the cantilever bridge across the Monongahela River, at Ferry street, for the Pittsburgh, Carnegie & Western (Wabash R. R.), is awarded to George W. McMullen & Co., New York, at about $250,000. The bids for steel work will be wanted in the fall. The weight of the superstructure will be about 8,000 tons. (June 28, p. 472.)

E. J. Taylor, Chief Engineer of the Pittsburgh Coal Co., 232 Fifth avenue, Pittsburgh, wants bids, until 4 p. m., July 26, for the stone abutments for seven bridges on the Moon Run R. R.

ROCHESTER, N. Y.—It is stated that plans have been approved by the Canal Board, and are now in the hands of the Superintendent of Public Works at Albany, ready for letting, for the Lyell avenue footbridge.

SAN MATEO, CAL.—The city has voted to issue bonds for $27,500 for building concrete arch bridges to replace wooden structures.

SOMERVILLE, ONT.—Sam. Suddaby, Clerk of Somerville, tells us that the county and the township are considering building a steel bridge of about 125 ft. over Burnt River in the village of Kinmount. The Ontario Government has granted $1,000 toward this bridge and the county officers would like to hear from bridge builders regarding the probable cost.

STEUBENVILLE, OHIO.—Bids are wanted, July 29, for the masonry on the Lacey bridge; also for the bridge over Short Creek at the mouth of Long Run. George P. Harden, County Auditor.

THREE RIVERS, MICH.—The City Clerk, it is reported, will order plans and specifications for a concrete arch bridge over Portage River.

TROY, N. Y.—The Commissioner of Public Works wants bids, until Aug. 1, for a steel bridge weighing about 3,000 lbs., for the Quackenkill pipe line of the Troy Water Works extension. John Phelan, Commissioner.

UKIAH, CAL.—The County Clerk will receive bids, until Aug. 6, for a bridge over Little River, according to plans on file in his office.

VALENTINE, NEB.—Bids are wanted, Aug. 15, for all bridges needed by the county prior to July 1, 1902.

VICKSBURG, MISS.—The county, according to report, is considering building a drawbridge, between 180 and 220 ft. long, over Big Black River at Fisher's Ferry. Wm. Curphey, President, Board of Supervisors.

Other Structures.

BINGHAMTON, N. Y.—It is reported that the Erie R. R. is making plans for a new station in Binghamton, which is to cost about $15,000.

BUFFALO, N. Y.—The Lehigh Valley R. R. has awarded a contract to A. F. Chapman & Co., of Buffalo, to rebuild the freight house and docks on the Tifft farm, which were destroyed by fire last month. The cost will be about $100,000.

CLARENDON, TEXAS.—It is reported that the Colorado & Southern has decided to rebuild the shops and roundhouse at this place which were destroyed by fire early in the month. The new buildings will be modeled after the plan of the Colorado & Southern shops in Denver.

ENSLEY, ALA.—The Southern Car & Foundry Co. is preparing to begin work on the new car plant mentioned May 31 (p. 372). The plans were made by the Osborn Engineering Co., of Cleveland.

LIMA, OHIO.—The Lima Locomotive & Machine Co. is considering consolidating its plant at Market and Jackson streets with the works at the South Side. It is also intended to practically rebuild the South Side plant and increase the capacity.

NEW COMERSTOWN, OHIO.—The Dithridge Steel Car Co. has secured a tract of land at this place for its plant, and plans are about finished.

NEW LONDON, CONN.—The Central Vermont contemplates spending about $400,000 on a grain elevator in New London.

PHILADELPHIA, PA.—The Reading Ry. contemplates making important improvements at a number of points, and bids have been asked for a portion of the work. The improvements for which bids are asked include a new one-story brick station, 19 x 60 ft., with overhanging roofs and concrete platforms, at Sellersville; new shelter sheds at Chestnut Hill, the present shed to be torn down for a distance of 220 ft., and the end of that portion left standing to be inclosed, and two new sheds, each 225 ft. long, to be built; a one-story brick office and storehouse, 16 ft. x 60 ft. at East Penn Junction, and a booth for cab calls in the loggia of the Terminal Station, east of the Market street entrance to the train shed.

PITTSBURGH, PA.—Plans are finished by the Pittsburgh, Virginia & Charleston for a new South Side station, which will be used for both passengers and freight. It will be modeled after the new Fourth avenue station, and it is to do away with the stations at South Nineteenth street and Ormsby.

It is stated that the engineers in charge of the Wabash extension into Pittsburgh, will soon make plans for passenger and freight terminals in Pittsburgh.

SALT LAKE CITY, UTAH.—According to report, the Rio Grande Western will build the proposed $200,000 machine shops in Salt Lake City, as planned before the change in ownership.

SAN ANTONIO, TEXAS.—Bids are wanted, until July 31, by E. B. Cushing, Engineer Maintenance of Way, Southern Pacific Co., for building a passenger depot for the G., H. & S. A., at the corner of Walnut and East Commerce streets, San Antonio. Plans and specifications may be had from Mr. Cushing.

TACOMA, WASH.—According to report, the Northern Pacific shops in South Tacoma will be enlarged at a cost of about a million dollars.

TOLEDO, OHIO.—The Lake Shore & Michigan Southern, according to report, will extend its dock front after the close of the navigation season.

The Cincinnati, Hamilton & Dayton will also build new docks for about a mile on the river front.

WASHINGTON, D. C.—Bids are wanted, until 1 p. m., July 27, at the Bureau of Yards and Docks, at the Navy Department, for structural steel work for a building 32 x 87 ft., in the Navy Yard at Washington.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvii.)

Canadian Society of Civil Engineers.

The Canadian Society of Civil Engineers will hold their summer meeting in Buffalo on Sept. 26, 27 and 28, at the rooms of the Engineering Society of Western New York. Mr. C. H. McLeod is the Secretary.

American Association for the Advancement of Science.

The annual meeting will be held in Denver, Colo., Aug. 24 to 31. The full programme has not been issued, but there will be addresses by the vice-presidents of the several sections, as follows: "Mathematics and Astronomy," James McMahon, of Cornell University; "Physics," D. B. Brace, of the University of Nebraska; "Chemistry," John H. Long, of Northwestern University; "Mechanical Science and Engineering," H. S. Jacoby, of Cornell University; "Geology and Geography," C. R. Van Hise, of the University of Wisconsin; "Zoology," D. S. Jordan, Leland Stanford University; "Botany," B. T. Galloway, U. S. Department of Agriculture; "Anthropology," J. Walter Fewkes, Bureau of American Ethnology; "Social and Economic Science," John Hyde, U. S. Department of Agriculture.

The following affiliated societies will also meet at Denver during the same week: American Forestry Association, Aug. 27 to 29, U. S. Geological Survey, Geological Society of America, Aug. 27; American Chemical Society, Aug. 26 to 27; Society for the Promotion of Agricultural Science, Aug. 23 to 24; Association of Economic Entomologists, Aug. 23 to 24; American Folk-Lore Society, Botanical Society of America, American Microscopical Society, Aug. 29 to 31.

PERSONAL.

(For other personal mention see Elections, and Appointments.)

—Mr. James Gayley, formerly Vice-President of the Bessemer & Lake Erie, has become First Vice-President of the United States Steel Corporation, with office at New York.

—Mr. A. H. Palmer, a Civil Engineer in the employ of the Illinois Central, at Anding, Miss., was shot and killed by W. K. Nolan, an employee of the company, at that place, on July 11. Mr. Palmer's home was at Jackson, Miss.

—Mr. J. M. Daly, late Superintendent of Transportation on the Lackawanna, and before that for many years on the Illinois Central, is now at Moncton, New Brunswick, where he has gone to organize the car service and fast freight departments of the Intercolonial Railway.

—Commodore Alfred Van Santvoord, President of the Hudson River Day Line of steamers, died on board his steam yacht, the "Clermont," July 20. He was actively engaged in his business affairs up to a few days ago. He was 83 years old and was born in Utica. His first connection with the shipping trade began when he became a clerk in his father's office. He was a Director of several railroad companies.

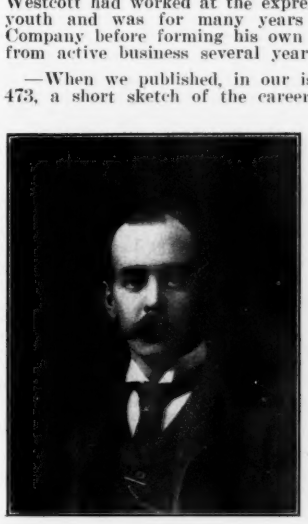
—Mr. Albert A. Sharp, Superintendent of the Yazoo & Mississippi Valley, at Memphis, Tenn., was born Feb. 18, 1844. He held various positions in both the transportation and traffic departments of the Western & Atlantic; Macon & Brunswick and the Louisville, New Orleans & Texas, becoming Superintendent of Transportation of the last named company in 1886. Three years later he became Division Superintendent of this company, which is now the Yazoo & Mississippi Valley.

—Mr. W. D. Robb, the new Acting Superintendent of Motive Power of the Grand Trunk, was born at Longueuil, opposite Montreal, Canada, Sept. 21, 1857. He entered the shops of this company at Point St. Charles as a machinist in 1873; and passing through various departments he became Motive Power Foreman in 1883. He was made Master Mechanic in 1897 and was promoted, July 15 of this year, to his present position, that of Acting Superintendent of Motive Power.

—Mr. W. D. Wiggins, Engineer of Maintenance of Way of the Cincinnati & Muskingum Valley, is a native of Indiana, having been born at Richmond, April 28, 1873. He was graduated from the Rose Polytechnic Institute in 1895. The same year he entered the service of the Pennsylvania Company and has been in the engineering department since that time, holding such positions as Assistant on Engineer Corps, Acting Assistant Engineer and Assistant Engineer. He assumed his new duties on June 16, last.

—Mr. Robert F. Westcott, founder of the Westcott Express Company in New York City, was killed July 19, near Richfield Springs, N. Y., by being thrown out of his carriage while driving over a rough road with an unruly horse. He was 75 years old, and the immediate cause of his death appears to have been apoplexy. Mr. Westcott had worked at the express business from early youth and was for many years with Dodds Express Company before forming his own company. He retired from active business several years ago.

—When we published, in our issue of June 28, page 473, a short sketch of the career of Mr. Delano, now General Manager of the Chicago, Burlington & Quincy, we were unable to get a photograph. Since then we have secured a photograph, which is now reproduced. It is still an excellent likeness, although it was made in 1895, and a man changes a good deal from 32 to 38, if his life is severe, and Mr. Delano's life has been very severe. In the picture reproduced one seems to detect a somewhat boyish wonder what is going to happen next. This expression has pretty well passed away from Mr. Delano's face in the last six years, as he has quite definite notions of what will come next.



—Mr. George Van Keuren, who, on July 1 last, was appointed General Superintendent of Transportation of the Erie, is 40 years old. He began his railroad career in 1880 as a chainman in the Engineer's Corps of the New York & Albany. The following year he went to the New York, West Shore & Buffalo and was engaged in the Engineer's Corps on preliminary survey, location and construction for three years. Then for the three years following he was on the New York, Lake Erie & Western as an Assistant Engineer of the Eastern Division, later becoming roadmaster of the same division. He then became Division Superintendent, Superintendent of Transportation and finally General Superintendent of Transportation of the Erie System.

—The Chairman of the Illinois Railroad & Warehouse Commission is Mr. James S. Neville of Bloomington. Mr. Neville was appointed to the Commission by the Governor in place of Mr. Lindly, whose term has expired, and he was elected Chairman by the Board on July 2. Mr. Charles J. Smith succeeds Mr. Joseph J. Joy as Assistant Secretary of the Commission. Mr. Neville was formerly the Attorney of the Commission and he has been succeeded in that office by Mr. James H. Danskin. We judge that the Legislature of Illinois does not require the railroads of the state to transport the Commissioners and their helpers free, as the notice announcing these appointments requests "the usual courtesies" for Messrs. Smith and Danskin.

—Mr. William B. Bulling, Assistant Freight Traffic Manager of the Eastern Lines of the Canadian Pacific, was born in Montreal in 1858. His first railroad experience was on the Grand Trunk in 1872. He resigned from this company in 1880 to go with the Chicago & Northwestern, but remained there only a short time, returning to the staff of the Grand Trunk. In 1889 he was appointed District Freight Agent of the Canadian Pacific and three years later became General Freight Agent of the Eastern Division of that road. This position he held up to the time of being appointed Assistant Freight Traffic Manager of the Eastern Lines, which comprise the entire line of the Canadian Pacific East of Fort William and Detroit to Quebec and St. John, N. B.

—Mr. O. M. Dunn, Division Superintendent at New Orleans, of the Illinois Central, was born in La Grange County, Ind., Aug. 14, 1847. He entered railroad service in 1864 on the Michigan Southern & Northern Indiana, now a part of the Lake Shore & Michigan Southern, serving in different capacities until 1872. In November of that year he went to the Louisville & Nashville as agent and operator. Eight years later he was promoted to the General Agency of the freight and passenger department, and in 1881 became Master of Trains of the New Orleans and Mobile Division. He became Superintendent of the same division in 1884. In 1892 he resigned from his company and became Superintendent of the Illinois Central, and when this position was abolished the following year (1893) he took the position of

Superintendent of the Louisiana Division, which position he now holds.

—Mr. John C. Moorhead, who has recently been appointed Assistant General Manager of the entire Erie System, is 57 years old. He was born at Moorheadville, Erie County, Pa., and entered railroad service in 1862 as a telegraph operator on the Lake Shore & Michigan Southern. From 1866 to 1868 he was train despatcher on the Atlantic & Great Western, and then for two years he held a similar position on the Erie Division of the Lake Shore. He was then appointed Assistant Division Superintendent of the Michigan Central. For three months he was Division Superintendent of the New York, Pennsylvania & Ohio, and on Nov. 1, 1888, became Superintendent of Transportation of that road. Three years later he was made Superintendent of the N. Y., P. & O. and the Chicago & Erie. Mr. Moorhead held the position of General Manager of the Ohio Division of the Erie from June 8, 1900.

ELECTIONS AND APPOINTMENTS.

Algoma Central.—J. W. Dawsey has been appointed Superintendent.

Central of New Jersey.—Joseph O. Osgood has been appointed Chief Engineer, succeeding J. H. Thompson, who has been assigned to other duties.

Chicago, Burlington & Quincy.—J. C. Sheehan, heretofore Superintendent of Bridges, has been appointed Superintendent of Bridges and Buildings, succeeding F. Eilers, resigned.

Chicago, Indiana & Eastern.—W. O. Hamilton has been appointed Auditor.

Columbus of Georgia.—H. S. Reynolds has been appointed General Manager. W. D. Keene, Superintendent, with headquarters at Columbus, Ga., has resigned.

Duluth, South Shore & Atlantic.—W. W. Walker, heretofore Assistant General Freight Agent, has been appointed General Freight Agent, succeeding W. Orr, resigned.

Grand Trunk.—The position of Assistant Superintendent having been abolished C. H. Bevington has been appointed Master of Transportation of the Middle Division, and will assume the duties heretofore performed by the Assistant Superintendent, with headquarters at London, Ont.

Gulf, Colorado & Santa Fe.—J. G. Hartigan has been appointed Division Superintendent, with headquarters at Cleburne, Texas.

Illinois Central.—R. S. Charles, Local Treasurer, has retired under the pension plan and that position has been abolished. His son, R. S. Charles, Jr., becomes Assistant Treasurer. A. H. Egan has been appointed Superintendent of Freight Terminals, with headquarters at South Water Street Station, Chicago. The position of Assistant Superintendent of the Chicago Division has been abolished.

Jacksonville & Southwestern.—J. J. Whittaker has been appointed Master Mechanic, with headquarters at Jacksonville, Fla., succeeding G. W. Eaves, resigned.

Minneapolis, St. Paul & Sault Ste. Marie.—W. C. Marshall has been appointed Assistant General Freight Agent, with headquarters at Minneapolis, Minn. This is a new position recently created.

Pennsylvania Company.—H. L. H. Blair has been appointed Assistant to the General Manager, effective July 18.

Seaboard Air Line.—Ernest Stump has been appointed Master Mechanic for the First, Second and Third Divisions.

Shreveport & Red River Valley.—H. B. Helm has been appointed Auditor, succeeding C. P. Murray, resigned.

Wabash.—The position of General Manager has been abolished.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BERKSHIRE STREET.—The contract for building 42 miles of this road, from Cheshire to Great Barrington, Mass., has been awarded to Fred T. Ley & Co., of Springfield, for about $600,000.

BROOKSVILLE & HUDSON.—Grading and track laying on this new Florida line, which connects the points named, has been completed for about two miles. There are no contracts, building being done by day's work. Hudson is about 45 miles southwest of Brooksville.

BUFFALO, NIAGARA FALLS & ROCHESTER.—This company has executed a mortgage at Rochester, N. Y., for $3,500,000, to Sutro Bros., of New York City. The funds secured by the mortgage will be used to build the road, work on which will be started immediately. (Feb. 1, p. 87.)

CANADIAN PACIFIC.—The contract for building the Wellwood and Wascada branches of this company in Manitoba has been let to P. R. Lambe, Fisher & McCutcheon, of Winnipeg, Man. (July 19, p. 524.)

CAPE GIRARDEAU, BLOOMFIELD & SOUTHERN.—It is reported that this company will build an extension southeast from Zeta to Morehouse, Mo., 14 miles.

CENTRAL OF VIRGINIA.—Surveys are said to be in progress west from Harrisonburg, Va., to Durbin, W. Va., about 65 miles.

CHICAGO & NORTHWESTERN.—The Moville Extension Co., which was incorporated in Iowa, June 12, has disposed of its franchise of the proposed extension from Moville to Sergeant's Bluff, Woodbury County, to the Sioux City & Pacific Ry. Co. The contract for grading this extension has been let to Winston Bros., of Minneapolis. The work of grading will be commenced at once. It is the intention to complete the line this year. (June 21, p. 448.)

CINCINNATI & DAYTON (ELECTRIC).—This company has been incorporated in Ohio with $10,000 capital, to build an electric line between the cities named, through Hamilton, Warren and Montgomery counties. The distance is 56 miles, and the C., C., C. & St. L. will be paralleled by the proposed line.

CINCINNATI & EASTERN ELECTRIC.—This company has filed a mortgage with the Cincinnati Trust Co., trustee, to secure $500,000 in 25-year 5 per cent. bonds, to provide for building a line along the Columbia & New Richmond turnpike from Cincinnati to New Richmond, Clermont County, Ohio, about 25 miles.

COLUMBIA, HUNTSVILLE & NORTHWESTERN.—The directors of this company are said to have decided to build the road northward from Trenton, Grundy County, Mo., to the Iowa line, 30 miles. The northern terminus will be Gainesville, Mo.

DANVILLE, FOURCHE VALLEY & SOUTHERN.—This line has been incorporated in Arkansas, to build from Danville to Cobb's Ferry, on the Arkansas River, 15 miles. The capital is $300,000, and it is to be a lumber road. J. S. Stafford, of Danville, is said to be interested.

EUREKA & PALISADE.—This company has been incorporated in Utah to purchase the present line (3-ft. gage) running south from Palisade, Nev., to Eureka, Nev., 84 miles. The capital stock is $300,000, and it is planned to extend the line.

FONDA, JOHNSTOWN & GLOVERSVILLE.—An officer writes that the contracts for the extension of this company's electric division and of the Amsterdam Street R. R., aggregating about 24 miles, will be ready for letting about Aug. 10. Bids are invited. (June 14, p. 421.)

FORT SMITH & WESTERN.—It is reported that the contract has been let for 20 miles of this new line from Panama, Ind. T., west through Indian Territory.

GEORGIA PINE.—Contract has been let to J. H. Davidson of Thomasville, Ga., and B. H. Hardaway, of Columbus, Ga., to build an extension of this line from Arlington to Columbus, Ga., 65 miles. The road is now in operation between Bainbridge and Arlington, 39 miles.

HILLSBORO & OHIO RIVER TRACTION.—This company has been incorporated in Ohio, to build an electric line south from Hillsboro to Aberdeen, on the Ohio River, passing through Highland, Adams and Brown counties, a total distance of 40 miles. The incorporators are: H. M. Huggins, of Hillsboro, and T. H. Hogsett, Charles Orr, Monroe Warren, F. E. McDermott and A. Z. Blair, of Cleveland.

LAKE ERIE, BOWLING GREEN & NAPOLEON.—This company has been incorporated in Ohio, to build an east and west line through Bowling Green. There are at present no east and west steam lines within 20 miles of that city.

LAKE ERIE & DETROIT RIVER.—This company intends to relay the Erie & Huron Division with 70-lb. steel rail. Our correspondent writes that the work will be done this fall.

MANITOULIN & NORTH SHORE.—Our correspondent writes that engineers are engaged in surveying the route for the Meaford & Owen Sound portion of this line.

MARION & NORTHWESTERN.—This company, recently incorporated in North Carolina, has been organized with an authorized capital of $3,000,000, to build a road from Marion, N. C., to coal fields of Tennessee.

MICHIGAN CENTRAL.—It is said that this company will build a line from Buchanan, Mich., five miles west to Niles, via the St. Joseph River route. The new line will have easier grades than the present road.

MISSISSIPPI ROADS.—Our correspondent writes that a plan is on foot to build a railroad from Natchez, Miss., on the Mississippi River, to Gulfport, Miss., on the Gulf of Mexico, 165 miles. S. S. Bullis and W. H. Hardy, through whose efforts the Gulf & Ship Island was built, are interested.

MONROE COUNTY ELECTRIC BELT.—This company has been incorporated in New York State to operate in Monroe County. The route extends from Brighton through Lincoln Mills and Fairport, and returns by way of Cobb's Hill, a total of 18 miles.

MONTICELLO, FALLSBURG & WHITE LAKE.—Franchise has at last been granted this company by the New York State Legislature to build its line from Fallsburg, N. Y., through Monticello to White Lake, 18 miles. (May 17, p. 342.)

MUNCIE, HARTFORD CITY & FORT WAYNE (ELECTRIC.)—This company has been incorporated in Indiana, with a capital stock of $100,000, to build a line between Muncie, Hartford City, and Bluffton and eventually to Fort Wayne. The mileage between Bluffton and Muncie is about 100 miles. The Lake Erie & Western is paralleled the entire distance.

NEW YORK & PORT CHESTER (ELECTRIC).—The Railroad Commission will give a hearing in New York City, on Aug. 5, to this company, which proposes to build a four-track electric railroad, most of which will be elevated, from the Harlem River, New York City, to the Connecticut State line. (June 28, p. 474.)

NORFOLK & WESTERN.—An officer writes that surveys are being made for a branch line up New River, about 64 miles into North Carolina.

NORTH AUGUSTA ELECTRIC & IMPROVEMENT.—Work is reported begun on this company's new line between Augusta, Ga., and Aiken, S. C. The distance is 20 miles, and the proposed line will parallel the Southern.

PENNSYLVANIA COMPANY.—Surveys are said to have been begun for a new line from Ravenna, 28 miles east to Niles, Ohio, connecting the Ashtabula and the Cleveland & Pittsburgh divisions.

PHILADELPHIA, WILMINGTON & BALTIMORE.—Work is reported begun on the Claymont cutoff for this company. The new track will be something over a mile in length and removes a bad curve at Claymont.

PLANT SYSTEM.—A charter has been given to the Savannah, Florida & Western to build from Jesup to Folkston, Ga. This is a cutoff of over 20 miles on the line between Jacksonville and Savannah.

PORTLAND, VANCOUVER & YAKIMA.—An officer writes that the contract for the extension 15 miles northeast from Battle Grounds to Yacolt Prairie, Wash., has been awarded to the Western Construction Co., of Portland, Ore. The contract includes a pile and frame trestle 1,546 ft. long, a 300 ft. rock tunnel with 700 ft. rock approaches, through the east point of Yacolt Mountain, and a 150-ft. Howe truss deck bridge. The maximum curvature is 6 deg.; maximum grade, 1.5 per cent. going north, and 0.6 per cent. coming south.

SANDUSKY, CLYDE, TIFFIN & SOUTHERN ELECTRIC.—This company has been incorporated in Ohio, to build an electric line from Clyde, southwest, to Tiffin. The capital stock is $10,000. The distance between the points named is 18 miles, and the proposed road will run parallel to the C., C., C. & St. L.

SANTA FE CENTRAL.—This company is reported as newly incorporated, with a capital of $2,225,000, by capitalists in Pittsburgh and New Mexico, to build 120 miles south from Santa Fe to Pinos Wells, N. Mex., to connect the Denver & Rio Grande and the Rock Island roads, and also the Albuquerque Eastern, a new line capitalized at $1,500,000, which is to extend to the San Pedro coal fields.

SHARON-NEWCASTLE STREET.—This company has voted to issue $500,000 bonds for building a trolley line from Sharon, Pa., to Newcastle, a distance of 21 miles. The proposed line parallels the Erie Railroad for the entire distance.

SPRING VALLEY & NORTHERN.—This company has been incorporated in Illinois to build and operate a railroad from Hall Township, in Bureau County, northward through the counties of Bureau, Lee, and Ogle, to Stillman Valley. The capital stock is $100,000, and the incorporators and directors are: F. P. Blair, R. J. Cary, M. D. Follansbee, Bertrand Walker and Frank Johnston, Jr., all of Chicago.

TILSONBURG, LAKE ERIE & PACIFIC.—Surveys are reported made for an extension of the line 17 miles northwest from Tilsonburg, Ont., to a junction with the Grand Trunk at Ingersoll, Ont.

VICKSBURG & SOUTHEASTERN.—This company has been organized in Mississippi to build a line from Vicksburg 125 miles southeast through a pine timber region, to Hattiesburg, Miss.

WABASH.—It is reported that the following contracts for the connecting line into Pittsburgh, Pa., have been let: Grading to the extent of $100,000, to Moran & Co., Pittsburgh; contract for a tunnel of $750,000, to William Kennefic, Kansas City, and bridges to cost about $1,500,000 to McMillan & Co.

WAYNESBORO, PASCAGOULA & GULF COAST.—It is reported that funds have been secured for building this Mississippi road. Dr. J. R. S. Pitts, of Waynesboro, is one of the promoters of the enterprise. The northern terminus will be Nashville, Tenn.

GENERAL RAILROAD NEWS.

BLUE RIDGE.—This road, which runs from Anderson to Walhalla, S. C., 34 miles, has been sold at auction to Fairfax Harrison, of Washington, D. C., and B. L. Abney, of Columbia, S. C. It is said that control is to go to the Southern, but the purchasers state that the road will be reorganized as a separate system.

BOCA & LOYALTON.—Notice is given to stockholders of a meeting at San Francisco, Sept. 19, to consider a bond issue of $225,000, for the purpose of paying outstanding indebtedness and for extending the line.

CAPE BRETON RY.—At the annual stockholders' meeting, the name of the Cape Breton Railway Extension was changed to the above. The $2,400,000 bond issue for proposed extensions (June 28, p. 473) was authorized, and the following directors were elected: W. Seward Webb, Shelburne, Vt.; Robert J. Campbell, Arthur Lameyer and Samuel R. Callaway, of New York; Michael Guerin, Montreal; John Jacob Astor, Edgar Van Etten, Frank G. Smith and Henry L. Spragge, New York.

CHESAPEAKE WESTERN.—This company has recently obtained control of the Chesapeake & Western, connecting with the Norfolk & Western at Elkton, Va., and extending west to Bridgewater, 27 miles.

CHICAGO, PEORIA & ST. LOUIS.—Notice is given to holders of the income bonds of this company and of the Litchfield & Madison, that these bonds are to be converted into new first preferred stock.

DENVER & RIO GRANDE.—This company will exchange Rio Grande Western preferred stock for D. & R. G. preferred stock, at the rate of 11 shares D. & R. G. for 10 shares R. G. W.

ERIE.—This company, for the first time, has declared a dividend of 1½ per cent. on its first preferred stock, payable Aug. 30. This dividend is payable out of the net earnings of the last six months.

HAGERSTOWN (ELECTRIC).—This company, in Maryland, has acquired control of the Myersville & Catoctin electric road. The latter line extends from Myersville, in the Blue Ridge mountains, through Middletown, where it connects with the line to Frederick, a total of about 23 miles.

ILLINOIS CENTRAL.—At the annual meeting, Oct. 16, the stockholders will be asked approve the issue of 132,000 shares of new stock to provide funds for the purchase of additional cars and engines, for new sidetracks, for the reduction of grades and other permanent improvements, and for other purposes. This will increase the capital stock from 660,000 shares to 792,000. The proposal stipulates that shareholders shall have the privilege of subscribing for the new stock at par.

PARKERSBURG & MARIETTA ELECTRIC.—This company will receive sealed bids at the office of the President in Parkersburg, W. Va., until noon, July 31, for grading, masonry and trestles on about 12 miles of electric railroad from Parkersburg to Williamstown. The work will consist of about 60,000 cu. yds. of excavating, 2,600 lineal ft. of piling, 332,000 ft. of lumber in trestles, and 500 cu. yds. of masonry.

PORTLAND.—This company has filed a mortgage to the Portland Trust Co., Portland, Me., to secure $3,000,000 of 3½ per cent. 50-year gold bonds, subject to call at par in 1931. These bonds provide for payment for the Portland & Yarmouth R. R., building from Portland to Saco, Me., 18 miles, with a branch to Old Orchard, and also for other improvements. There is also a reserve for taking up outstanding mortgages whenever desired.

ST. LOUIS & BELLEVILLE.—This company has absorbed the property of the Mississippi Transit Co., which includes the electric line known as the East St. Louis, Collinsville, Caseyville & Edwardsville, of which 11 miles has been completed between East St. Louis and Collinsville, and about 12 miles more is projected. The line parallels the Terre Haute & Indianapolis.

TOLEDO, FREMONT & NORWALK (ELECTRIC).—This line is said to have been purchased by the Everett-Moore Syndicate. It is 61 miles long and connects the cities named.

WORCESTER RAILWAYS & INVESTMENT.—This company has been organized at Worcester, Mass., to control the street railroads which center at that city. The company has a capital of $6,000,000, and will purchase the stock of the Worcester Consolidated, the Worcester & Suburban, Leominster & Clinton, Worcester & Marlboro and the Worcester Traction Co. The total length of these roads is about 135 miles.